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THYRSOSTACHYS OLIVERI.

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A handsome new Burmese Bamboo.

The picture which forms the frontispiece to our January number and consequently to our twentieth Volume, represents a new bamboo from Upper Burma, belonging to a new genus *Thyrsostachys*, which is characterized by its thyrsoid paniculate bracteate inflorescence and paleæ keeled in the lower flowers and not or hardly keeled in the upper and having the lower ones deeply divided so as to present two long tails. The bamboo was discovered by Mr. J. W. Oliver, Conservator of Forests of the Eastern Circle of Upper Burma, and the photograph, from the negative of which our picture has been obtained, was taken by him. It is, therefore, only appropriate that its name should be *Thyrsostachys Olivieri*. Full description and plate will shortly be published in the Annals of the Royal Botanic Garden, Calcutta. Mr. Oliver says that the *Thanawa*, as it is called in Burmese, is in considerable demand, though the culms are not quite so strong as those of some other species. Large quantities of the seed were distributed from Burma and we have it growing excellently in Debra Dun where there is a considerable patch of it planted at Lachiwala, doing very well indeed. As the picture shews, it is likely to be as ornamental as it is useful.

J. S. G.

A Tour in Jaunsar. (*concluded.*)

THE SLEEPER WORKS.

The Sleeper Works are at present going on in the Dopta Block on a steep slope facing south west.

The trees are marked by the divisional officer or the forest ranger with a blaze and the divisional hammer. They are then felled by a special gang of men, generally Garhwalis from the neighbouring villages. The rates paid are as follows :—

All dead trees, each	4 annas
For a green tree 6—8 ft. girth ...	6 annas
ditto 8—10 „ ...	8 „
ditto over 10 „ ...	12 „

The felling is done with the axe alone, and the trees are generally felled sideways, *i.e.*, neither up the slope nor down it; this tends to lessen the chance of breaking.

The tree is then sawn into logs of the requisite length—in the case of metre-guage sleepers, 6 feet 3 inches long, and in the case of broad guage sleepers 10 feet 3 inches long. Each log is then rolled down to a convenient place for the sawyers and is rough squared on four sides by means of the trimming axe. The axe used varies according to the workmen—Kulu men using a broad bladed axe weighing about 14 lbs, Punjabis a thicker narrower and lighter axe weighing 6 or 7 lbs; in both cases the handle is long.

The saw in use for cutting up the logs into sleepers is a frame saw bought at Amritsar, but manufactured either at Sheffield, or at Solingen in Germany.

The following rates are paid for sawing :—

B. G. 1st Class ...	6 as. each
2nd „ ...	4 „ „
Rejected ...	2 „ „
M. G. 1st Class ...	2 as. 9 p. each
2nd „ ...	1 „ 9 p. „
Rejected ...	9 p. „

In the forest, to allow for wear and tear in transit, the sleepers are sawn to the following dimensions :—

B. G.	10' 2" × 10½" × 5½"
M. G.	6' 3" × 8½" × 4½"

the dimensions required by the railway authorities being respectively 10 × 10" × 5" and 6' × 8" × 4".

The sleepers are then stacked and inspected by the forest ranger, who passes them and marks them with a broad arrow, as follows :—First, every sleeper is marked once on the broadside, to denote that it is Government property; then a *first class* sleeper receives three marks on one of the narrow sides; a *second class* sleeper receives two marks, and a *rejected* sleeper one additional mark, both on the broadside.

A first class sleeper must have the proper dimensions, must be free from cracks and knots, especially at about 18 or 30 inches from either end, according to the size (M. G. or B. G.) and must contain no sapwood. Second class and rejected sleepers fail in one or more of these qualities. The first and second class sleepers are then carried to the head of the sledge road at Chabbai and piled up in large stacks. Rejected sleepers can also be taken down to the Dun as there is a fair market for them in Dehra for building purposes.

The cost of carriage from the forest to Chabbai varies with the distance, the rates paid this year from the Dopta block being about 6 annas for a B. G. and $3\frac{1}{2}$ annas for a M. G. sleeper.

For logging, the Kulu men use a two-handed cross-cut saw, and the Punjabis use an ordinary saw, about three feet long. An experiment was made in the presence of the students to test the respective merits of the saw used in Jaunsar, the new German saws from the Forest School, and the Punjabi saw; two large trees were felled and sawn up into logs, with the following result.

The Punjabi, working by himself, took on an average six minutes to saw through a square foot; the Kulu men, working two together, with M-tooth saw took 4.4 minutes to cut through a square foot; with the upright isosceles triangle, took 5.3 minutes; and with the ordinary cross-cut saw, as used in Jaunsar, 10.9 minutes. This experiment, as far as it goes, shews that the Punjabi can do more work in a given time than the Kulu man, and that of the cross-cut saws, the M-tooth one is the best. These saws are manufactured by Messrs J. D. Dominicus and Söhne, of Remscheid-Vieringhausen, Rhenish Prussia, and cost about Rs. 5-8 each landed at Bombay.

We took advantage of the measurements of one of these trees to ascertain the reducing factor. The girth at the base was 128"; at 10 ft., 112"; at 20 feet, 106.5"; at 30 feet, 102.5"; at 40 feet, 98.5"; at 50 feet, 92"; at 60 feet, 89"; at 70 feet, 82"; at 80 feet, 75"; at 90 feet, 70.5"; at 100 feet, 63.5"; at 110 feet, 62"; there was an additional length of 30 feet too small for timber.

We thus obtain the mean girth of each log in inches, and multiplying the square of this by 0.08 we get the area of the mean section, and thus arrive at the true volume of each log. Adding all those together, we obtained 499.92 cubic feet as the real volume, and with 1274.31 cubic feet as the cylindrical volume deduced from the total height (140 feet), and girth (128") at the base, we found 0.39 as the reducing factor. Last year we found 0.47 as the reducing factor for a tree 13 feet girth at the base. It is obvious that this factor will not tell us how many sleepers can be obtained from a tree of this girth; all we learn is that the tree contains so many cubic feet. To ascertain the number of sleepers we must be guided by past experience.

We noticed heart-shake in the tree we cut up, owing probably to rapid growth ; the shake extended from the centre for 3 or 4 inches radially in opposite directions, and would render a portion of each log unfit for sleepers.

MANUFACTURE OF DEODAR OIL AND CHIR PITCH.

This is effected by the destructive distillation of chips of deodar wood taken from the heart-wood of stumps. The kiln is made of stones and mud mortar, and is faced with lime inside. It is egg shaped, 5 feet deep, 4 feet greatest diameter at six inches above the base ; the base has a diameter of 2 feet, and the top of 2½ ft.

About 13 maunds of wood are put into the kiln and fire is applied at the top, and the supply of air is regulated by partially closing the mouth. One charge yields 2 maunds 10 seers of oil and 1 maund 4 seers of charcoal, and it is estimated that the cost per maund of oil delivered in Chakrata is Rs. 5-10-7. The oil is not pure, and at present there is no sale for it on a large scale, though it would doubtless prove a valuable disinfectant. It is a safeguard against bites of the "potu" fly.

A similar preparation is that of Chir pine tar, described as follows in the Journal for 1891 :—

"The tar is separated by subjecting small pieces of Chir pine wood to slow, incomplete combustion in a kiln, through which only a small supply of air is allowed to pass.

The kiln is made of stones and mud mortar, the interior being faced with lime, and is egg shaped inside ; its height and also its maximum diameter being 5 feet. It tapers towards the lower end, into which is fixed a perforated iron plate. At the upper end of the kiln is an opening 2 feet in diameter.

The wood, cut into long strips 1 or 2 feet long and 4 or 6 inches round is introduced at the upper end of the kiln. The pieces of wood are packed as tightly as possible, the closer they are together the better. The upper opening is then closed with a dome of stones and mud mortar, three holes being left to admit air. The wood is lit from the top and burns downwards, the rate of burning being regulated by closing or opening the different holes.

The charge of the kiln is about 15 maunds, and it takes 6 days to burn, the volatile products being driven off and charcoal remaining in the kiln.

Crude tar, organic acids and water pass through the perforated plate at the bottom, and are collected in tins. Good pitch, the cost of which has been estimated at Rs. 4-8-0 per maund delivered at Meerut, has been made by driving off the water and organic acids.

The cost of the kiln was Rs. 13.

From 15 maunds of wood thus subjected, we get 6 maunds of charcoal and one and one-fifth maunds of crude tar.

The tar is used locally for railings, &c, and the pitch is used on iron roofs. There is probably a more ready sale for this production than for deodar oil.

THE DEOBAN KARSHU FOREST.

Owing to delays in marching caused by the heavy winter snow, we were only able to devote one morning to the interesting forest on the slopes of the Deoban hills; hence what follows is taken principally from previous journals.

The Karshu forest occupies the top of the Deoban hill, at an average elevation of 8,500; it consists principally of Karshu oak, with spruce and silver, the latter especially in the western side.

On the northern slopes below Snow View, where the soil is fairly rich owing to a combination of shale and limestone, and the gradient not too steep (about 28°), the karshu oak forms an almost pure forest, and attains good dimensions. In 1888, we measured the height of two oaks with Abney's level; one was 117 feet and another 94 feet. We also measured an old stump which had a girth of 15 feet.

The natural reproduction of this oak by seed is fairly good; on a piece of ground 10' by 10' we counted 205 seedlings, which gives about 90,000 per acre. This, however, was in an area free of *Strobilanthes*, which, as a rule, covers the ground in this forest. The history of this plant is exceedingly interesting, and for a full account of the species found in the Nilgiris, see a paper in the *Indian Forester*, Volume XIV, No. 4, for April, 1888, by Mr. Gamble. The chief species found at Deoban are *S. Wallichii*, and *S. alatus*. Every year the upper herbaceous portion breaks off at a node, leaving the woody stem beneath, which increases in length by one or two inches every year, until at the time of flowering, when the plant dies, this woody portion is two feet high, the height of the whole plant being five feet. The last seeding took place in 1881-82; the new shoots (the woody portion) are now from 12 to 15 inches high and about eleven years old. When the next flowering will take place we do not know, but it is believed that the whole term of this plant is about 12 years.

In all probability it is only when this plant dies down that the young karshu seedlings are able to force their way successfully through the dense network formed by the roots.

The *Strobilanthes* is a plant which flourishes under the dense cover of the silver fir; it is also a favourite fodder for sheep and goats, but grazing cannot, of course, be allowed here as the karshu seedlings would be destroyed.

In July, 1887, Mr. Moir sowed karshu acorns in contour lines six feet apart, but they were nearly all destroyed by the larva of a moth. This acorn has numerous enemies, principally birds, squirrels, and bears. The karshu acorn is ripe in July and August, and

germinates as soon as it reaches the ground. The germination of this oak is peculiar. From the acorn there issues a long cotyledonary tube at the end of which is carried both the radicle and the plumule. The radicle then forms a thick carrot-like tap-root, fed by the nutritive materials from the cotyledons, and the plumule bursts out from the crown of this taproot. On this subject, the reader is referred to *Indian Forester*, Vol XVII, p. 48, for an interesting article by Pandit Keshavanand. The germination of the Moru Oak is somewhat similar.

The sowings were renewed in 1888, and the countings we made shewed on an average one seedling per foot of contour line. They are now thoroughly established and are doing well, although the rate of growth at this elevation is necessarily slow.

In 1892, the students pulled up the *Strobilanthes* by the roots over an area of about 1-12th of an acre; and this work has since been continued, and there is now an area of $5\frac{1}{2}$ acres quite free from *Strobilanthes*. We found numerous seedlings in the cleaned area and it is expected they will grow all the better for this operation. The cost is about Rs. $6\frac{1}{2}$ an acre. The natural reproduction by seed of this oak presents matter for further study, and we cannot as yet determine what is the best kind of felling to make in these forests; one point should never be lost sight of, and that is, at this elevation, wind, storms, and heavy snow have to be taken into account, and the selection method by which the cover is kept as complete as possible, is indicated. On the western side of this hill, there are patches where the selection method may be shewn as a type, chiefly in silver fir; but on the northern side, in the Karshu oak, we do not find all ages mixed on the ground. The present appearance of the forest, where fuel fellings have taken place, is that of a severe seed felling, and it remains to be seen how the reproduction will come on.

There are many interesting species in the undergrowth, of which the more important are:—*Skimmia Laureola*, a small shrub belonging to the N. O. *Rutaceæ* with a strong aromatic odour; the native name of this plant is "Kustoora chara," and the odour of the musk deer is popularly supposed by the hillmen to be derived from the leaves. *Salix daphnoides*, a willow with lanceolate glabrous, slightly serrate leaves, glaucous beneath, capsule glabrous. *Viburnum cotinifolium*, N. O. *Caprifoliaceæ*, leaves with dense grey tomentum underneath, ovate or rotundate, 3 to 5 inches long, with short thick petiole. *Viburnum nervosum*, *V. stellulatum*, *Spiræa canescens*, a species of raspberry *Rubus niveus*, various species of *Lonicera*, *Berberis*, and many others.

Another interesting species is the larger ringal (*Arundinaria spathiflora*); it flowered all over Jaunsar in 1882, and a few of the dead stems may still be found, though they are quite rotten; it is chiefly used as pipe stems, and it also forms excellent fishing rods for trout and mahseer. The ground is covered with young seedlings, which are now about six feet high. It will be some years

yet before the stems of this bamboo attain the height and size requisite for fishing rods, and it is probable that the term of this species is longer than was originally supposed. It can be at once distinguished from the lower elevation bamboo, *A. falcata*, by the cross veins.

In the Jadi block, just above the road to Kanjatra, there is a small karshu coppice of 1882; the average height of 282 shoots in 1888, was 4 feet 8 inches, and the average number of shoots per stool was $5\frac{1}{2}$; very few standards were left, but a quantity of willow has come up on the ground; the aspect of this *coupe* is south-west. In 1891, the average height of 400 shoots was 6 feet 8 inches.

Another coppice in the Mohna block below Chakrata, view with a northerly aspect and cut in the same year, was also examined: the average height of 107 shoots in 1888 was 4 feet, and the average number of shoots per stool was seven. Only the leading shoot in each clump was measured. In 1892, we found the average height of the leading shoot in each clump to be 6 feet 3 inches. The karshu oaks pollarded in 1878, near the coppice in the Jadi block, shew an average height of 15 feet.

In the Journal of 1891, we found the following data regarding the rate of growth of karshu:—

“The students measured the girths of the Karshu and Rai in the sample plot in the Jadi block below the road to Bodyar: the results of the measurements since the beginning are given in the following table, which refers to the growth of the Karshu oak:—

Number of trees measured.	Class girth.	Mean Girth 1883.		Mean Girth 1891.		Mean increase		No. of years required for an increase of 1" radius.
		Ft.	in.	Ft.	in.	Ft.	in.	
60	Under $1\frac{1}{2}'$	1	1.0	1	4.2	0	3.1	17.00
58	$1' - 3'$	2	1.4	2	5.1	0	3.7	14.00
16	$3' - 4\frac{1}{2}'$	3	8.2	3	11.6	0	3.5	14.75
2	$4\frac{1}{2}' - 6'$	5	0.5	5	0.5	0	2.2	23.55

The measurements made, so far, seem to shew that it will take 180 to 190 years before this Oak attains a girth of six feet. Countings of rings on stumps which were made in 1892 serve to corroborate this.

THE DEODHAT NURSERY.

This nursery, situated in the Mohna block about a mile below the bungalow, was instituted in 1878 for the purpose of raising plants to re-stock the blank slopes. Water is led by means of a small canal from a neighbouring spring, and stored in casks; and the beds are hand-watered wherever necessary. In 1891, there were about 17,500 Deodar transplants which have since been put

out ; and in 1892, about 12,000 plants were pricked out, either into nursery lines, or into baskets. This year there are 20,000 Deodar, and 20,600 Silver fir. The beds are protected against the sun by means of grass tatties.

Various plantations have been made from time to time in the Mohna block. In Katbau—North we visited plantation No. 4 of 1881 on an easterly aspect and gentle slope. It was sown with Deodar in 1881 and subsequently with blue pine in vertical lines and re-sown in 1882. Vacancies were filled up in 1883 with transplants from the Deothat nursery, and with spare plants from neighbouring patches. The first sowings were made too thickly, and in 1891, superfluous plants were cut out ; we counted 76 stumps in one patch : with three plants left to grow. The following measurements have been made :—

1891, average height	135 Deodar	...	4 ft. 5 in.
1892, do.	574 do.	...	4 ft. 7 in.
do. do.	77 blue pine	...	3 ft. 7 in.

The average length of 26 annual shoots of deodar was in 1892, $10\frac{1}{2}$ inches. Here as elsewhere deodar does best when sheltered by the pine.

In Rangai—North, we inspected plantation No. 5 of 1881. The soil is shallow and rocky and the general aspect is South. Deodar was sown in 1881 in patches 4 feet apart, in horizontal lines 15 feet apart. Blue pine was sown subsequently and vacancies were filled by putting out deodar plants in 1883. Lower down, where the soil is deeper and the area is protected by spurs on either side, the deodar is doing much better.

In compartment 14 of the Mohna Block, beyond Kauntilani, is situated a plantation of 1881. Deodar and blue pine, raised in the nursery, were put out in August 1881, when about $2\frac{1}{2}$ years old (seed of 1878), in alternate lines 14 feet apart. The aspect is S. and S. W.

In 1888, average height of	deodar	...	5 ft. 0 in.
do. do.	blue pine	...	10 ft 0 in.
1892, do.	of 31 deodar	...	7 ft. 3 in.
do. do.	„ 51 blue pine		12 ft. 0 in.

The average length of 31 annual sheots of deodar was 11 inches.

In all these plantations in the Mohna block it would have been better had the plants been sown or put out much closer, say 5 ft. x 5 ft..

SOWINGS IN KANJATRA BLOCK.

In 1885, spruce and silver fir were sown in contour lines one foot wide, and 8 to 10 feet apart. The growing stock is young spruce fir, with a little silver, on a north westerly aspect and the natural reproduction is almost nil. The total length of the lines is about 18 miles, and the cost of making them was Rs. 164.

The following method of recording the success or failure was adopted : a stick four feet in length is placed along the line ; if one or more seedlings are found within that length, it is recorded as a success, if none are found, it is considered a failure. Counting on this system in 1888, silver fir showed a success of 50 per cent., while spruce fir showed a success of 32 per cent. As the two species were sown in alternate lines, at any rate below the road, this shows that the spruce fir has largely died out ; the reasons for this probably are :—1st, want of sufficient light ; 2nd, too much moisture ; for a little further on, where the lines turn round a spur, we noticed that the spruce fir had done very well.

In 1891, the success of both species was estimated at 40 per cent. ; and in 1892, the success was found to be $37\frac{1}{2}$ per cent. Another method of shewing the results is to say that there is a plant on an average to every $6\frac{1}{2}$ feet of line. In 1892, a spruce seedling was found with a height of 18 in., and another with a height of 16 in., and two silver firs gave an average of 10 in. In the forests beyond the Kanjatra block, good natural regeneration of silver fir was noticed under thick cover : spruce fir found naturally where the cover was very light or interrupted, being as a rule, confined to the ridges.

We inspected the fuel works in compartment 5 of Kanjatra forest, Deoban Hill. The following general description applies to fuel works in this range :—

After the trees are felled, they are cut up by means of the cross-cut saw into lengths of two feet ; these logs are then split by axes and wedges into pieces of convenient size, no piece being allowed to weigh more than 12 seers, or to be more than 9 inches diameter. The fuel is then placed in stacks of the following dimensions, 21 feet long, 6 feet high and 2 feet broad ; this is supposed to contain, and is counted, as 200 cubic feet of fuel, 1 foot in length and 1 foot in height being allowed for shrinkage, loss in re-stacking, &c. The rates paid for felling, logging, and stacking are as follows :—Oak, Rs. 2 per 100 cubic feet ; fir, Re. 1-12-0 per 100 cubic feet ; this work is done entirely by hillmen, who earn in the course of the year about Rs. 2,300 at this work alone.

The fuel is carried on mules and ponies to Chakrata, at the following rates :—

Oak,	Re. 1-6-0	per 100 cubic feet	per mile.
Fir	„ 1-2-0	ditto	ditto.

Every quarter of a mile is marked along the fuel roads, and the nearest quarter of a mile to the fuel stack is taken into consideration when paying the carriers. At the present rates received for the fuel in Chakrata, it does not pay to carry the fuel from any place outside a radius of 12 miles from that station, hence the forests in the Deoban range must remain the chief source of supply for some time to come.

The trees to be felled are selected either by the ranger or the divisional officer : a small blaze is made on the tree and it is marked at the base with the divisional hammer. The tree is felled by the axe at about two feet from the ground, and is generally made to fall sideways. Felling by the axe causes a good deal of waste, but it is found almost impossible to cut large trees with a saw.

The weight of 100 cubic feet stacked oak fuel is about 40 maunds when fairly dry, and that of 100 cubic feet fir fuel about 28 maunds.

Wherever fuel works are going on, a series of roads or carrying paths four feet wide have to be made. As a rule they have to be metalled, and the Deoban limestone furnishes a good material for this purpose, whereas the shale is too soft and only lasts one season. These paths cost about Rs. 4 a chain to make and Rs. 2 a chain to metal. When the fuel works are over for any particular locality, the paths are allowed to fall into disuse ; but when the next felling comes round, they are easily cleared at a small cost and can serve again.

The fuel supply for Chakrata, which amounts to about 1,40,000 st. cubic feet per annum is derived from various forests in the Deoban Range :—Deoban, Lokandi, Konain, Kophti and Hajawa, besides the coppices at Gidhi Khud, Korwa and Kalsi.

Another effect of the influence of Climate on Forest Vegetation.

It is generally known that the character of forest vegetation mainly depends on two causes—the locality and the climate. The latter cause is probably the more powerful element in this respect. It is simply due to the change of climate that some trees which form very extensive forests in the moist region would simply vanish in similar localities where the annual rainfall does not exceed 20 inches ; while there are others which would hardly be found except in localities where the annual rainfall falls below 20 inches.

As an instance of the first type of trees may be mentioned the three-needle Pine of the Himalayas, while the Edible Pine and *Quercus Ilex* may be mentioned as representing the latter kind of trees.

Again there are others which would grow both in the dry as well as in the moist climate, though they may not attain equal dimensions under both these circumstances. Deodar, the most important tree of the Himalayas, is one of such trees.

The great difference between the size of the trees of *Pinus longifolia* found in Khanpur in the Hazara district where the climate is comparatively dry, and those found in Nûrpur in the Kangra District, is no doubt owing to no other cause.

Now, it is true that Deodar does not confine itself to the moist region of climate nor does it ever suffer from an excess of moisture in the air, but the further we penetrate into the Himalayas in the dry region of climate, the slower we find its growth.

And all slow growing species, are, I believe, much more valuable as timber trees than the fast growers.

The inference may therefore be drawn that a Deodar tree which grows in a dry climate where its growth is comparatively slow will yield a more durable wood than the one which comes up in the moist region of climate. But the case is just the reverse.

If the Deodar wood grown in the dry climate remains exposed to sun and rains for a time it changes its color and cracks and splits very badly. Nor does it contain a sufficient quantity of resin. So it is much lighter than, and consequently inferior to the rapid grown wood of the moist climate.

Besides the slow growth and small size of trees, the inferior quality of wood is therefore another thing which is due to climatic influence.

The very marked difference in the quality of the Deodar wood sold at the different sale depôts in the Punjab is probably due to this one cause.

The Ravi Deodar is said to be the most durable. Next to it comes, I believe, the Chenab Deodar and the Jhelum Deodar is not inferior to that of the Beas, which latter is much superior to that of the Sutlej.

Now, what is said of Deodar wood under such circumstances is equally true of all other species.

Thus as a matter of fact the climate forms the mainspring of the machinery which regulates all important changes in the Forest vegetation.

KULU,
18th May, 1893. }

MIAN MOTI SINGH.

Note on the Pests of the Teak Tree.

BY MAJOR C. T. BINGHAM.

At page 46, No. 2, Volume XVIII of the "Indian Forester," there is a note by Mr. J. Nisbet, Deputy Conservator of Forests, on the damage done to the teak plantations in the Pegu Circle by the larva of a moth.

This moth, called by Mr. Nisbet, "*Tortrix (Tectonæ ?)*," does not, so far as I know, occur in Tenasserim. During the past three years, while on tour in the forests, I have made careful search and been always on the look out, but have failed to find it. Quite recently also at my request Mr. P. W. Healy, Extra Assistant Conservator of Forests, went the round of the whole of the teak plantations, and over much of the natural forest in the Ataran valley, without coming across a single teak tree attacked by the pest.

As it was a matter of some importance to procure the moth and have it properly identified, on the 23rd April of this year I sent a servant, who has been used to collect insects for me, to Rangoon and by the kind permission of Mr. Jellicoe, Deputy Conservator of Forests, in charge of the Rangoon Forest Division, he was enabled to proceed to the teak plantations in the Magayi reserve, where the plague of caterpillars destructive to the leaves of the teak had set in. This plague, I believe, occurs annually in some portion or another of the Rangoon Division.

Some 50 or 60 larvæ were procured by my man, who returned on the 30th.

Unfortunately, I had been obliged a day or two earlier to go out into the district, and I did not return till the 6th May.

On examining the box containing the caterpillars, which had, according to directions I had left, been looked to daily and fed with fresh teak leaves, I found that the majority had not only pupated, but that a good number of the moths even had issued. Luckily, however, there were still some 12 or 15 remaining in the larval state.

The moths I found were of two species.

One, a soft dark robust-bodied moth, with an expanse of 1·3 inches, has been identified by Mr. Cotes, as a Noctues moth of the family *Hyblæidæ*, species *Hyblæa puera*, Cramer. On the *upper side*, the ground colour of the fore wing is ashy grey with a tinge of yellow shaded at the base of the wing on the disc, along the costa, and broadly along the outer margin with soft dark brown; hind-wing dark brown with an irregular band on the disc not reaching the costa, and a large squarish mark at the anal angle vermilion red. Cilia of the fore-wing dark brown, of hind-wing brown with a light wash of pink. *Underside*, both wings pale vermilion red turning at the base, along the costa and on the disc of the fore-wing to yellow; an irregular mark on the fore-wing and two spots at the anal angle of the hind-wing, with some indistinct shadings dark brown.

The larva measures a little over one inch in length. It is whitish yellow beneath, dusky greenish above. Along the middle of the back is a pale flesh coloured stripe with darker smoky brown stripes one on each side, which latter are each outwardly margined by an indistinct and somewhat interrupted white line. Head dark brown; a few erect dark hairs scattered over each segment.

The second species, Mr. Cotes informs me, is new to the Indian Museum collection, but that it is undoubtedly one of the Pyrales and very close to *Paliga* (*Scopula*) *damastesalis*, Walker.

The following is a brief description of the larva and moth.

Larva: length 0.7 to one inch. Colour pale sap-green; two lines of purplish spots along the middle of the back. Head yellow; a few pale erect hairs scattered over each segment.

Moth: expanse 0.9 inches. *Upperside* pearly white with a slight creamy tinge; fore-wing marked along the costal and outer margins and across the disc with spots of red, forming on the last indistinct narrow red cross bands; hind-wing with the outer margin narrowly edged with the same colour. Ciliæ of the fore-wing alternately red and white; of the hind-wing pure white. *Underside* pearly white.

The larvæ that had not pupated had all turned by the fifth day after my return. Both species seem to take the same length of time over their metamorphosis, the moths issuing from the 8th to the 11th day after pupation.

The *Hyblæa* formed a rather flimsy cocoon either in the corner of the box, or along the mid rib of a leaf, dragging the sides of the leaf slightly together with the web. The *Pyrallis* invariably rolled itself up in the edge of the leaf, holding it in position by a few threads.

My recollection (for I unfortunately have mislaid the notes I took) of the ravages of these caterpillars when I was in charge of the Rangoon Division, is that they appeared in the teak plantations on or about the 20th May, sometimes in almost incredible numbers. Their ravages were confined to certain areas, where they re-appeared year after year stripping the young teak of their leaves with the rapidity almost of locusts, and hanging in thousands by webs to the branches of the trees.

It is quite possible that *Hyblæa puera* may, like the *Tortrix murinana* mentioned by Mr. Nisbet in the paper above quoted, pupate among the dead leaves on the ground, but, if so, I should fancy few individuals could survive, for a plantation attacked by these pests is a wonderful scene of activity. Numbers of jungle fowl, ground thrushes (*Pitta*), and insectivorous birds of all kinds crowd to the spot to feed on the caterpillars.

The *Pyrallis*, as I have already said, rolls up the edge of a leaf and is thus rendered less conspicuous and saved from enemies. It certainly occurs in far greater numbers than the *Hyblæa puera*.

(INDIAN MUSEUM NOTES.)

MAULMAIN;
18th June 1892.

(1) The specimens have since been submitted to Colonel C. Swinhoe, who has kindly examined them and determines the species as *Paliga damastesalis*, Walker.

IV.—REVIEWS.

Reports on Botanical Gardens.

The reports on the Saharunpore and Mussoorie Botanical Gardens, the Horticultural Gardens at Lucknow, and the Gardens and Parks in the Nilgiris, for the year ending 31st March, 1893, have been received. As usual, the report for Saharunpore is the most interesting of the three. The Superintendent of the Gardens will in future look after District Arboriculture, for which he receives a small allowance. It is said that the absence of trained advice is often felt by the District Boards, but why have they never thought of the local Forest Officer who could easily give the benefit of his opinions especially in the rains, when probably most of the planting is done?

The Jalap plant has been attacked by a disease, and its successful cultivation in the N. W. Himalaya appears to be extremely doubtful. In other respects many interesting experiments have been carried out, and we are glad to see cold water thrown on acclimatised seed, sold to Tommy Atkins at 8 Annas a pound, to produce "peas consisting of straw, tomatoes of leaf and stalk, spinach running into flower, beets and carrots without roots, &c." in future only those kinds which do well though acclimatised will be distributed.

In the Lucknow Gardens, some of the Avenue trees have been attacked by fungus, probably arising from old stumps left in the ground, thus shewing the advisability of digging out stumps when old trees are removed to make way for young ones. *Eucalyptus tereticornis* has flourished more than any other species of gum, and the leaves have again been used for engine boilers. These gardens as well as those at Saharunpore very nearly pay their expenses.

The Nilgiri gardens with a favourable season have done very well, and have been maintained in excellent working order. Here the fluid extract from blue gum is used for boilers, and the results will be given in the next report, and the manufacture of Eucalyptus oil is now being undertaken by private persons.

The Cape Forest Reports for 1892.

This volume contains six reports, all of them of considerable interest and recording excellent work done, though as with other Colonial work, we should like to see more attention paid to the establishment of properly demarcated and settled state Reserves even at the cost of a diminution of the valuable planting work effected.

The first Report is that of the Conservator of the Western Circle, whose charge includes also the Cape Peninsula, and the plantations on the Flats, at Worcester and Kluitjes Kraal near Ceres. The Worcester Plantation consists of blue gum and is being worked in coppice for pit props, up to date it has given a surplus profit of £835. It is intended to fill vacancies with *Jarrah* (*Eucalyptus marginata*) which does well. The Kluitjes Kraal plantation of 500 acres has been found to have been too thinly planted and this is now being remedied by interplanting. At the Tokai Plantations on the slopes of Table Mountain, many changes have taken place; the old Manor House, formerly the Conservator's residence, has been given up, and the rather desultory sparse planting is being filled up to a proper distance and we are glad to see that greater use is being made of the Pines (*P. Pinaster* and *P. insignis* especially) which do so well at the Cape. It is also intended to grow the pencil cedar (*Juniperus bermudiana*). The large Tokai nursery supplies large numbers of trees to purchasers for planting in Cape Town and its suburbs and so serves a very useful purpose. On the Cape flats, the chief tree grown is a wattle (*Acacia saligna*) of which great things were expected as a tanning material. These expectations, however, have not been realized, but the firewood seems to sell well.

The Conservator, Mr. D Hutchins, very properly advises more planting in the Cape Town streets and there can be little doubt of the value of his advice. He also recommends wood paving for the streets, and says that in the Knysna forests, tongued and grooved yellow-wood flooring is now being regularly made, as that wood (*Podocarpus*) has proved superior to pine.

We are very glad to see that much attention is being paid to Table Mountain and in our opinion the whole available area on it should be reserved and the tree growth protected by systematic fire-belts, allowed to grow up, being assisted where necessary artificially. On the subject of fires, the Conservator expresses his feelings strongly and picturesquely as follows :—

“ It cannot be too often repeated that these fires are the direct result of bad Forestry. A clean, dense plantations of oaks, and of most other trees, is quite safe from fire. And even in the case of Pines, a dense clean plantation runs little risk from fire

‘after six or eight years of its existence. But the dirty, irregular, and sparse plantations, that are so common on the slopes of the Table Mountain, simply invite fires, and are sure to be burnt sooner or later. The approximate cause is of little consequence. The only result of squandering money on rangers and watchers is to postpone the conflagration, and make it worse when it does happen. I speak with 20 year’s experience of the subject, 10 of which relate to India, where forest fires are an evil of terrible magnitude, but one that is successfully met and overcome. But, as regards Table Mountain, the subject lies in a nut-shell. It is a simple little question of bad Forestry, without even the difficulties that occur in the more severe climates of the Knysna forests and of the Amatola forests near King William’s Town. An owner who allows his plantations to degenerate to a jungle of scattered trees and rank ground herbage, is a nuisance and a danger to his neighbours, and I trust before long will be brought under penalties similar to the owner of a flock of scabby sheep.

‘In the Colony, I have followed the history of the destruction of numerous tracts. The story is invariable. It begins with irregular fellings that are excessive in certain places. As the trees are opened out, herbage and bush cover the once clean forest soil, and then come fires. If the evil be not taken in hand at once and the burnt patches immediately replanted, they will gradually extend until the forest is pushed back to the dense kloofs, where it is nearly fire proof, though even here, if axe and fire act together as they did in the forests of the Stockenstrom division the kloofs will eventually be burnt out. The destruction of the Stockenstrom forests went on for many years, the forest being all the time under the strict Government Conservancy regulations which on the whole were faithfully carried out. But it was considered necessary to show a revenue, for which wood had to be cut and the normal capability of the forest was exceeded. The natural law by which the dense forest protects itself from fire was broken and the inevitable consequence followed.”

A commencement has been made in the training of forest officers, and Mr. C. B. McNaughton was sent to Coopers Hill for training and is said to be doing well there.

The Midland Circle Conservator has charge of the great Knysna Forests where the chief tree is ‘Stinkwood’ (*Oreodaphne bullata*) and work chiefly consists in supplying sleepers for the Government Railways, while improvement works are not neglected, for we see that a large area has been gone over in improvement thinnings in order to free Saplings of Stinkwood and other valuable kinds. Demarcation and survey are also going on and the following description of the demarcation work will be read with interest in this country.

“The boundary lines of the reserves are laid down on the ground (except where unnecessary, as along the crests of mountains, &c.) by means of live beacons placed in preference on the tops of the ridges that are intersected, so as to be visible from each other. Through the forest the clearing of these lines becomes a long and tedious operation which costs nearly £10 a mile in labor alone. The lines are set out daily or almost daily with a theodolite, but a forester is usually competent to produce them alone during the intervals between each setting, by means of a prismatic compass.

‘It is intended to replace those corner beacons of the reserve to which materials may be carried by permanent beacons. The importance of this work can scarcely be overrated.

‘Without substantial beacons, many of the boundary points become lost or altered within a few years, and it has been my unfortunate experience to find that many of the ordinary property surveys within these districts, which appear, from independent evidence, to have been made accurately enough, have become almost worthless on that account. And a single beacon altered tends to throw discredit on the best of work, since, without further evidence, it becomes a matter of doubt whether a discrepancy may be due to the altered position of a beacon or to inaccuracy in the previous work. On the other hand, the uniform agreement of the positions of these beacons, such as masonry beacons which obviously cannot have been tampered with, would always establish a strong presumption of the accuracy of the recorded positions of other original points.

‘Owing to the difficulty that was experienced in getting a suitable stone-mason for the work, I was led to adopt beacons made of a block of concrete cast *in situ*, normally 2 feet below and 2 feet 6 in. above the ground, and 20 in. square at the ground level, tapering to 15 in. square at the top, a hole 2 in. square being left down the centre for fixing survey signals and to serve as a centre mark. The cost is reduced, by dispensing with a stone mason at comparatively high wages, and with the transport of stone (suitable kinds for breaking up into concrete being found nearly everywhere), from about £3 to under £1-7s.0d. including materials, labour, and transport, and it will be probably still less where the beacons required to be built are not far apart.”

In the Eastern Circle, Mr. J. S. Lister is the Conservator, and his head-quarters are at King William's Town. His Report is interesting, though there is little which requires special note in these pages. And the same is the case with the Report of the Conservator, Mr. Henkel, on the Transkei Circle, one of the most noticeable points in which is the system of giving Free Permits to Kafirs : on this Mr. Henkel writes as follows :—

“ As pointed out in the Annual Report for 1891, a very large and trained staff is required to watch Natives cutting Wattles, poles and kraal bushes under “Free Permits” which have to be granted by the Resident Magistrates. Applicants for a Free Permit, as a rule, do not proceed to the forests themselves, but send boys, often their own sons or relatives, to cut for them. I have personally observed that young and valuable timber trees were girdled and partially cut through out of pure mischief by these native boys. Young timber so injured blows down during strong winds and does a great deal of damage to the forest.

“ The Natives are now well acquainted with the different species of timber trees, the reserved trees are shown to them by the Foresters and Native Forest Guards.

“ The heathen Kafir, when he can afford it, marries two or three wives, consequently the Bantu race is fast increasing. It has been calculated that in 16 years time their numbers will have doubled themselves: therefore, if the present system of building huts, kraals, &c., &c., is continued, large Wattle plantations will have to be established to supply their requirements, as the supply is almost exhausted.

“ The civilizing influences of Missionary and Government brought upon the native races, have been hitherto of very little avail, but if the original plan of Government, of separating locations by belts of farms had been carried out and these sold to industrious European farmers, the force of example would have been the means of rousing the Natives to energy and thrift.”

The value of the Free Permits thus granted by Resident Magistrates during the year, amounted to £15,295 while the collected revenue was only £1,956. The complaint is the same that has been made in Ceylon, and all we can say is that the Bombay Forest Officers have, at any rate, the advantage that the privileges in their forests are fixed and recorded so that they know what to expect; in Transkei, the case seems to be that as fast as the Forest Officers work to raise trees, the magistrate issues permits to cut them down. We suppose that the day for regulation and settlement will come sometime, meantime we congratulate the Cape Forest Officers on their energy and are glad to note a distinct record in this Report of a tendency towards more regular conservancy and more scientific management.

VI.—EXTRACTS, NOTES AND QUERIES.

In the Amador Second-growth Forests.

Amador county is one of the most neglected portions of the Central Sierra region of California. It lies between Calaveras and El Dorado, and extends from the edge of the valley eastward to the summit. In outline it is something like the Isthmus of Tehuantepec, irregular, and narrow in the middle. It is large, thinly populated and very mountainous. Historically it has been one of the most active of the old mining counties. Large quartz mines are in operation there, but the placer mines were long ago exhausted.

A branch railroad extends east from Galt, in Sacramento County, to Lone, in Amador. Stages run to the towns and villages as far as Volcano, about twenty-five miles further east, and 3,000 feet above the sea. At the present time (May 1st), and for six or eight weeks longer, Volcano will be the end of the stage route; in summer the stages go "to the snow-line." For the trip to Volcano the last of April is probably the pleasantest part of the year, for the roads are not dusty and the weather is delightful, though the nights are still cold—about thirty-degrees at times—so that one needs a heavy overcoat if travelling late.

When Amador was first settled, Yellow pines of great size stood in forests down to the 1,200 feet level, and Sugar pines began to mingle with them at about 1,500 feet. A little higher came the *Libocedrus*, and then the Douglas spruce while the pines continued. The Oaks were also very large and fine. All these earlier trees, except a few Oaks, have been cut down, and the face of the country, except in small scattered clearings, is covered with second growth and coarse bushes of no economic value. All the lumber used by the people comes from forty miles further east. Even there the large trees are nearly gone, except in almost inaccessible gulches. The selling price of rough, averages \$ 20.00 per thousand in Jackson, the county-seat, though it is hauled forty miles over steep roads. None of the mills are making much money. Spruce, deodar and pine lumber are rated at about the same price. The mines use a great deal of heavy timber in shafts, drifts, tunnels and buildings. Teamsters are seen bringing down logs sixteen feet long and three feet in diameter to the lumber-yards of the leading mine companies; such a log is worth fifteen or sixteen dollars and hundreds of them may be seen piled up near the mine-shafts.

In some parts of the country there are gulches that are fairly dotted with old tunnels, shafts and dumps. Everywhere there is evidence of immense energies spent upon mines now worked out or abandoned and millions of feet of lumber have been buried underground. The undeveloped resources of the region are very great, and new ledges are being opened every year. It is easy to see where the famous forests of Central Amador have gone, and now the forests of the upper ridges are being used. Although the county is one of the best portions of the Sierras, its available timber-supply has steadily decreased since its settlement. The view of some writers that the timber-supply of the country is increasing seems most ridiculous here.

A great deal of the lumber cut has been taken from Government land. Everybody admits this, but seems to think it hardly right to prevent it. Every saw-mill owns land, of course, but somehow all the accessible Government sections are in second-growth, exactly the same as the sections that have been entered. That tells the story to an unbiassed observer.

The second growth is very beautiful, and even over the larger part of many square miles it is in exactly the condition now that an intelligent forester would like to have it, if he were to take charge of the district. Twenty thousand acres of second-growth Pine (*P. ponderosa* and *P. Lambertiana*) are to be seen from the County road between Clinton and Volcano (about ten miles), that only need thinning and protecting to become in due time as valuable as any forest on the Sierras. There is a great deal more that would repay care, and many thousand acres which are valueless except for timber, but which could be planted. The settlers start fires to destroy brush and under-growth, and improve pasture, and every few years these fires run over large territories, destroying the second-growth pines. There are not many sheep and cattle in the region now, but they come up from the valleys later. The second-growth pines average five or six inches in diameter, with many small trees struggling in the dense under-growth of the more treeless slopes of chapparal. (*Garden and Forest.*)

London Trees.

Before parting with the memorable summertide of 1893, it may not be profitless to observe its effect upon trees, so essential to the beauty and health of the Metropolis. They afford the one redeeming feature to an otherwise ugly town.

Some years ago (writes Sir Herbert Maxwell, M. P., to the *Times*) I brought upon myself a good deal of adverse criticism by quoting Leigh Hunt's saying that it was hard to find a single street in London from some part of which a tree was not visible. I only know of two—viz., Savile Row and a street parallel with Berners Street.

London trees have two adverse influences to resist—coal smoke and heat reflected from miles of brick and stonework. The effect of the latter is so clearly marked upon several species at the present moment that the lesson ought not to be neglected by the Office of Works and by those in charge of squares and gardens, for although the heat has been greatly excessive this year, trees in a town are always exposed to greater summer heat than those in the country.

The trees which have suffered most are one native species—the wych elm—and two exotic species—the horse chestnut and the lime. The condition in which these are now and have been for some weeks past ought to convince us of their unsuitability for urban planting. Many of them are entirely leafless; others retain but a sore remnant of summer clothing.

The plane, for which we shall soon have to borrow the title of a humbler green thing and call it “London pride,” has stood the trial fairly well, for, although it has shed half its leaves, the other half remain and are still fresh and verdant. By a popular mistake (pointed out some years ago in the *Garden* newspaper) the tree is called the Western or Occidental plane. It is not so, but an Eastern European and Asiatic species (*Platanus acerifolius*), and may be distinguished from the American *P. occidentalis* by bearing two or more seed vessels on the fruit stalk instead of one.

Aspens and poplars have suffered not at all, and should be more largely planted in London. By a peculiar formation of the leaf stalk, which is flattened midway, they are specially provided with a mechanical means of protection against heat. The leaves hang vertically and possess glands on both surfaces, whereas oak, beech, chestnut, &c., have glands only on the under surface.

But the tree to which Sir Herbert Maxwell calls special attention as invaluable for towns is what is commonly called the acacia. It is not an acacia at all, being of the pea-flower tribe; its scientific name is *Robinia Pseudo-Acacia*. Let any one compare the fine specimen standing at the corner of Lord Sefton's house in Belgrave Square, or a group of young ones in the Green Park, near Wellington Arch, with trees of other kinds around, and he cannot fail to recognise in this species one which, for beauty of form or freshness of verdure, cannot be excelled for planting in towns.

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[No. 2.

Utilization of the less valuable Trees.

I desire to draw the attention of the readers of the *Indian Forester* to a large subject, which during my Indian career has often occupied me, I mean the utilization of the less valuable trees, of those which in forest reports are sometimes called *kokat* or common jungle trees.

It will be remembered that the first successful attempts on a large scale, to protect the forests against the annual fires, were made in 1865 by Colonel Pearson in the Central Provinces and were continued by Colonel Doveton. The Bori forest, south of the sandstone scarp of the Pachmarhi block in the Satpura range, gave us the first opportunity of seeing the wonderful effect of fire protection. When I visited Bori in company with Captain Doveton in the hot weather of 1869, the forest was a dense and compact mass of luxuriant growth, and the open spaces in it were rapidly filling up with seedlings and coppice shoots. And in Bori, as well as in other forests of the Satpura range, which it was at that time possible to place under efficient protection, this improvement has, I understand, steadily progressed. At the same time we saw what had been anticipated from the beginning, that the less valuable kinds, *Terminalia*, *Anogeissus*, *Lagerstroemia*, *Nauclea*, *Garuga*, *Boswellia*, *Odina* and the like, were profiting equally with those species that commanded a ready market, that is, with *teak*, *Pterocarpus* and bamboo. Similar results have followed efficient protection wherever protection was real and not on paper only. In the plains the common jungle trees, in the hills the inferior pines, multiplied equally with *teak*, *deodar* and other paying species. In places with a large fuel demand, such as Darjeeling, Chakrata and others, the inferior woods are sold as firewood or are made into charcoal, and in regions with dry climate, where forests are poor and scanty, and where consequently every stick is valuable, in Sindh and Rajputana, it did not much matter which species were favored by efficient protection. In most forest districts, however, the enormously increased production of the inferior woods threatened to become a real difficulty in the management of efficiently protected forests. Under these circumstances, it will readily be understood that the question of finding employment for those inferior woods has always appeared to me one of paramount importance. In the sal forests, where *Shorea robusta*, the most valuable species, is

gregarious, and consequently, as a rule, preponderates over the less valuable kinds, this question fortunately does not arise, the demand for kokat woods being generally sufficient to admit of what I would call uniform working. The same may fortunately be said of the forests of *Hardwickia binata* in Central and Southern India. But even in sal forests it has, I understand, at times been found difficult to dispose of the inferior woods which were cut or which ought to have been cut in improvement fellings. The last issue of the *Indian Forester*, on page 395 of Vol. XIX brings an interesting communication on the extension of wood pavements in Great Britain and the United States, for which purpose jarrah and other Australian timbers have, of late years, been largely imported. The writer justly urges that efforts be made to utilize such Indian timbers for wood paving blocks as have not yet, like teak, an assured and permanent market. As regards the harder kinds of wood, such as *Xylia dolabriformis* and *Terminalia tomentosa*, this is an excellent suggestion.

For the so-called inferior pines of the North West Himalaya their employment as Railway Sleepers and Telegraph poles, after impregnation with zinc chloride, copper sulphate and other antiseptic substances, is an obvious idea, considering the large extent to which impregnated wooden sleepers and telegraph poles are employed in many countries of Europe. Commencing with Dr. J. Warth's excellent paper, which he read at the Forest Conference of 1875, and which was printed in the second volume of the *Indian Forester*, numerous proposals for the impregnation of the Himalayan pines on a large scale have since that time been made, and the writer of these lines has certainly not neglected any opportunities to bring about the establishment of impregnation factories in Northern India. These efforts have failed: the desire on the part of the Engineers to employ iron sleepers was too strong, and the forest interest had no chance. Perhaps this is not to be wondered at, for even in North Germany, the iron sleeper has gained ground steadily and this has mainly been the case because the iron interest is more powerful at the present time than the forest interest.* I would, however, advise my younger friends in India and those Indian foresters whom I do not know personally, but of whose labours I read with interest in official documents, and in the *Indian Forester*, not to lose sight of this idea. Eventually, I feel assured that the impregnation of Himalayan pines and perhaps also of other woods, will come to be an important business in India.

*In 1891-92 the total length of single lines on the State Railways of the kingdom of Prussia was 45,620 kil or 29,800 miles. On iron sleepers were laid 11,862 kil or 26 per cent. During the same year, 2,647,801 new sleepers were put down measuring 407,363 cu. metres solid wood, equivalent to 14,391,000 cu. ft. and costing 13,087,478 marks. Thus there is still a good demand for a considerable quantity of second class wood, and, fortunately, a large proportion of these sleepers is beech wood impregnated. The use of iron sleepers, however, has of late years made steady, though slow progress.

It is not impossible that the collection of resin and turpentine from some of the Indian pines may in some forests be the means of utilizing those species, the wood of which in the climate of the plains is not durable. I was glad to see in the Appendix Series, of the *Indian Forester*, a very useful paper upon this subject by Mr. Edgar Thurston.

And it is quite likely that factories of paper pulp may, in course of time, be established on some of the rivers which issue from the North West Himalaya. In many forest regions of Germany, the wood pulp factories established during the last 20 years have had a great and most beneficial effect upon forest management, by creating a steady demand on a large scale and at remunerative rates. Those forest students of Coopers Hill, who were with me on the forest tours between 1888 and 1891 may recollect the large number of wood pulp and cellulose factories in Saxony, in Bavaria, and in the Black Forest. Such factories have been built all over Germany wherever a sufficient supply of spruce and silver fir is readily available. The paper, upon which the "Times" is printed in London, is to a great extent made of cellulose and wood pulp manufactured in the Murg valley of the Black Forest. It will be remembered that about 1878 the paper manufacturers of Great Britain were in despair because the supply of linen rags, and of Esparto grass from Spain and Algiers, seemed quite insufficient to meet the rapidly increasing consumption of paper. A distinguished representation of some of the leading paper mills came to India, armed with strong recommendations from the authorities at home. Bamboo paper pulp was then regarded as the last resource of the starving paper mills, and it seemed a national duty to make over the Bamboo Forests of Burma to the paper interest. The enthusiasm for bamboo paper, however, was of short duration. Wood pulp and cellulose factories had already been established, the article soon found favor, and the steadily increasing production of that article has entirely set at rest the apprehensions of paper makers in Great Britain. When, in 1890, the ravages of the "Nun" in the Ebersberger Park in South Bavaria necessitated the cutting and sale of 55 million cubic ft. of spruce timber, no difficulty was experienced in selling the first class timber at fair rates owing to the excellent arrangements made by the Bavarian Forest Department, but there would have been serious difficulties regarding the disposal of smaller stuff, if the large cellulose (chemical wood pulp) factory near Mannheim had not purchased nearly the whole of it. Wood-paper pulp in Europe is at present almost exclusively made of spruce and silver fir, but the wood used in the first instance was the Aspen, and it is not impossible, that besides the Indian pines the wood of some broad leaved species may eventually be utilized in this manner.

Iron making with charcoal perhaps offers, in most parts of India, the most promising field for utilizing the surplus wood, which eventually must be the result of efficient protection and good management. The subject has been repeatedly discussed in official and non official publications, but strange to say, no vigorous action seems as yet to have been taken. It is satisfactory, however, that the subject has lately again been prominently brought forward by Mr. Holland is No 8 of the Handbooks of Commercial Products. That portion of India where, in the interests of good forest administration and in the interests of the country generally, it seems most desirable to revive the old native iron industry, is the Madras Presidency, with its unrivalled deposits of rich iron ore and with its absence of mineral coal. When, in my Suggestions regarding Forest Administration in the Madras Presidency of 1883, in the Chapter 'Forests and Iron,' and elsewhere, I endeavoured to urge early action in this direction, I hoped that a few years' effective protection of the reserved forests in the Salem and other districts would make it possible to commence operations.

What I have been able to learn from the Annual Reports of the Madras Forest Department, from the *Indian Forester*, and from other sources, has been disappointing. As regards the drier districts, at least, I have looked in vain for evidence that the reserved forests have materially changed their character. I have nowhere seen any indication, that any part of them now forms dense compact masses of forest growth. Mr. Holland, on page 13 of his paper, gives extracts from a special report submitted to the Government of Madras in January 1892. In this report the timber fit for charcoal burning, that may be expected annually from the forests situated within convenient distance of the great iron ore beds in four Taluqs of the Salem district, is estimated at 20,000 tons a year. The area is given for two Taluqs only: *Salem Taluq* 47,800 acres, estimated to yield 5,736 tons a year, or 0.12 tons per acre; and *Uttankarai Taluq* 31,946 acres, estimated to yield 8,140 tons a year, or 0.25 tons per acre. Now, if these figures correctly represent the actual condition of these woodlands, forest management in the Salem district would not seem to have made very great progress since 1883. On page 177 of my Madras Forest Report, may be read a brief account of the Nimayampatti reserve in the North-east corner of the Salem district, on low hills at the foot of the Yelagiris, the standing crop on which, about 12 years old, was estimated at $2\frac{1}{2}$ tons per acre, corresponding to a mean annual yield of 0.2 tons per acre, a very poor yield; the forest, however, had not been protected from fire.

The same yield, it was then expected (page 180), might be furnished under effective protection by a railway fuel reserve formed in 1866 and proposed to be extended to 50,000 acres, along the railway line at the foot of the Shevaroy hills. But

these were areas with very poor, stony soil. For those reserves in the Salem district, the produce of which would be available for iron making, an annual yield of half a ton per acre was estimated.*

Under the operation of the Madras Forest Act, good progress seems to have been made in the demarcation of reserved forests in the Salem district. Out of 2,578,000 acres of Government unoccupied land, † not less than 487,000 acres had, by 31st March, 1892, been declared reserved forests under the Act. The point, however, is, whether this large area or part of it has been protected efficiently. Looking to the figures quoted above, this seems to be open to doubt. If indiscriminate grazing and cutting is permitted, it cannot be expected that the condition and production of forests will improve. Certainly, one of the objects in forming reserved forests in the Madras Presidency is to provide for the agricultural population in the vicinity a permanent source of supply of fuel, bamboos and building wood, and of cattle fodder, as far as this is compatible with the rational management of the forests. It does not, however, follow that for this purpose the whole area must be thrown open to grazing and cutting. Selected blocks ought to be completely closed against grazing, and against cutting, as far as such may not be necessary in the interests of the forest, at least during a time sufficiently long to ascertain the capabilities of the woods thus treated.

At this time, ten years after the passing of the Madras Forest Act, which is acknowledged to be a useful enactment and one that meets the requirements of the case, and after the establishment of an organization, which is now generally admitted was a good one; in the Salem district, at least, to all appearances no real progress has been made in the one essential condition of success in forestry, the determination of the annual yield of woodlands in different localities under efficient protection and under a good system of management.

As regards the Iron question, no operations on a large scale can be undertaken, unless the annual yield of the available forests is determined, and this was the first step which I urged should be taken in this matter. The second step was not to let the existing Native iron industry die out for want of fuel. Then two measures, the necessity of which I endeavoured to urge in my Report, are as necessary now, as they were in 1883. Certain carefully selected areas must be set apart and must not be touched, except where thinnings and improvement cuttings must be made. But, outside these selected areas, such arrangements must be devised, as will enable existing native iron works to obtain the necessary fuel for their operations. The proposals of my Madras Report, however, went further. I explained that if it were decided to leave the commencement of iron making operations on a large scale with improved methods to private enterprise, action must be

*Madras Report, p. 184. † Madras Report, p. 272.

delayed, until a sufficient area of forest had for some time been efficiently protected, and had attained a condition in which the required yield per acre could with certainty be depended upon as a permanency. My recommendation, however, was different. I urged that operations should be started on Government account for the improvement of the native method. I suggested that an attempt might be made, gradually to improve the native process in the direction of making it less wasteful, by introducing the indirect process and employing blast furnaces of a moderate size, so constructed and arranged, that native workmen could keep them going. This idea was originally started by Dr. Warth, in a paper which he wrote in 1881, on "Iron making in India." At the same time, I submitted that this would require a metallurgist, practically conversant with charcoal iron making, to be attached for a time to the Forest Department of the Madras Presidency. This has not been done. It is not for me to consider, whether the importance of maintaining and gradually improving the native iron industry has been sufficiently recognized by the Government of the Presidency. The subject has doubtless received due consideration, for, quite apart from the forest question, the interests of those classes and tribes in the different districts of the Presidency, which formerly depended upon iron making, seem to demand earnest consideration.

However this may be, my advice to the forest officers in those districts, where the old native iron industry has not yet been extinguished, is to devise means to prevent its extinction, and secondly to endeavour to introduce such improvements in the native methods of iron making, as will ensure greater economy of fuel. Ball, in his *Economic Geology of India*, gives some data showing the great waste of charcoal in this process. On page 351, he draws attention to the excellent account given by Dr. Buchanan of iron smelting in Malabar, which he visited in December 1800, and where, in order to produce from 256 to 324 lbs of malleable iron, 1,890 lbs of charcoal were used, which is about 6 times the weight of the iron obtained (*Journey*, Vol. II, page 438). On page 384, Ball describes the process in the Jabalpur district, where one maund of wrought iron requires, in the first instance, 6 maunds of charcoal to make kachcha iron, and then 4 maunds of bamboo charcoal for refining. And, on page 341, he states that in some cases the consumption of charcoal fuel for the production of finished iron is as 14 tons of the former to 1 ton of the latter.

It may be urged, that it is hopeless to effect any improvement and to introduce economy of fuel in the place of the present wasteful native method, considering the failures of the numerous attempts made in the Madras Presidency and in other parts of India, to establish a remunerative charcoal iron industry with improved methods. The discontinuance of operations at Porto Novo, Beypore, Trinomalai and Pulampatti, in Nimar, at Dechauri below

Naini Tal, in the Jubbulpore district and elsewhere, are certainly disheartening, but in none of these undertakings has the forest question been dealt with in the right manner. At the risk of being tedious and of saying things which each Indian forester knows, as well as I can explain them, I would urge once more, that the most promising tracts should be selected for the experiment in the first instance, tracts which, if properly treated, will produce a heavy annual yield. Even in Europe, there are very great differences in the annual yield of forests stocked with the same species. The spruce woods of the Ebersberger Park in Southern Bavaria, had, before they were attacked by the Nun, an annual yield of 50, while those of Weingarten in Southern Württemberg produced 100 cubic feet per acre. Whether the splendid Eucalyptus plantations on the Nilgiris and the Casuarina plantations in the plains have since 1883 been steadily extended and properly managed, I have no means of knowing; in those days I had good grounds for expecting, that over large areas, the former would yield annually 6 tons, and the latter 2 to 6 tons an acre. If large areas producing timber at these rates were available, it might pay to carry the more valuable iron ores to the places where the charcoal is produced. But all these are matters of detail, which must be settled on the spot, by persons acquainted with the actual condition of things at the present time.

In Europe, the employment of charcoal for iron smelting has within the last 60 to 80 years greatly diminished, mineral coal being now almost universally employed. Vast areas of beech forests, the produce of which formerly found remunerative employment in iron smelting, have to a great extent lost their value by this change, and it is in many instances difficult to dispose of their produce. There is a certain analogy between the beech in Germany and the inferior woods in India. The increased production of mineral coal has greatly diminished the use of beech wood as fuel, and has, in many districts, extinguished its use for iron smelting. An extensive area stocked with magnificent beech woods, called the Kermeter forest, situated in a bend of the river Roer, which some of the Coopers Hill forest students may remember, runs at the foot of the Hohe Venn and lower down, passes alongside the Hambach forest range near Jülich, formerly produced the charcoal consumed by a number of large iron works in the Schleiden valley. In those days, every stick produced here was utilized, and most of it was converted into charcoal made in large kilns which were established in the vicinity of the annual cuttings. About 40 years ago, the competition of iron made with mineral coal in other parts of Rhenish Prussia, became so severe, that the iron works in the Schleiden valley were gradually closed. Some of them have resumed operations, but are now working with coke brought from a great distance. In the Siegen country, the excellent ores found there, mostly spathic iron, were formerly

smelted with charcoal, mostly oak, the produce of the extensive coppice woods (Hauberge), which some of those Coopers Hill men, who accompanied me in 1888 and 1889, may perhaps remember. Here the Iron industry is as flourishing as ever, indeed it has latterly been developed on a very large scale. But mineral coal, which is brought from the coal districts near the Ruhr valley, has taken the place of charcoal. Changes of a similar kind have come about in England. The charcoal made of the Dean forest beech wood, was at the beginning of this century used in the iron works of the neighborhood, until it was replaced by the coal which was found underground in that forest.

Iron made with charcoal, however, has qualities which render it almost indispensable for certain purposes, hence the maintenance of charcoal iron works in Sweden, in Austria, and in some parts of Germany.

Some the Coopers Hill men may perhaps remember the large works at Jenbach in the Inn valley below Innspruck, which we visited in 1889. In Rhenish Prussia there are seven charcoal iron works, one (Jünkerath) in the Eifel mountain range, the other six in the country on the headwaters of the Sieg and the Lahn rivers. In 1892 these works employed 1024 men; the ore worked up by them that year amounted to 33,308 tons, to which were added 2,082 tons of limestone, and they produced 16,834 tons of pig iron. The largest work, Müsen in the Siegen country, made 5,317 tons during the year. In one of these works situated near Dillenburg, 850 to 900 lbs of charcoal was used to make 1,000 lbs. of pig. The direct process of making wrought iron, which is the old native Indian process, has now everywhere been abandoned in Germany. It was nearly as wasteful as the Indian process, 100lbs. iron requiring from 300 to 800 lbs. charcoal. This, however, it must be remembered, was wrought iron.

A singular confusion would seem to exist in the minds of some writers upon this subject in India. Thus, a writer in the *Pioneer* of 20th March 1893, quoted in the *Indian Forester* of September last (page 340) places Dr. Schlich's estimate of $2\frac{1}{2}$ tons of charcoal required to produce one ton of iron against that given in my Madras Forest Report (page 57) viz., $3\frac{1}{2}$ tons. But Dr. Schlich, writing of the Barwai iron works in Nimar, spoke of pig iron (15 tons a day or say 5,400 tons a year) requiring 372,604 maunds of charcoal; whereas I spoke of finished, or wrought iron. The same writer states that in the Blandfer furnace $16\frac{3}{4}$ cwts. of charcoal were used for one ton of pig. This is about the quantity at the present time used in Germany. The quantity of charcoal required, varies with the construction and management of the furnace, the temperature of the blast, and many other circumstances: among others, the nature of the ore and the quality of the charcoal. Assuming that, under good management and with the

best modern appliances, one ton of pig iron would require one ton of charcoal, an annual outturn of 10,000 tons would demand 10,000 tons of charcoal, corresponding to 40,000 tons of wood. This, however, is pig iron, which, on conversion, gives a smaller quantity of wrought iron or steel. Without entering into details regarding the fuel required for this process of conversion, which varies within very wide limits, it may be assumed that under favorable circumstances, and with the best modern appliances, 20,000 tons of charcoal may, by the indirect process, be made to produce 10,000 tons of wrought iron or steel bars. In 1883, the data then before me did not seem to justify so favorable an estimate, and I was right in assuming that 35,000 tons of charcoal would be required to make 10,000 tons of finished iron.

Regarding the area required to produce this quantity, there must be more data available now than I had been able to collect in 1883. I have, however, looked for them in vain in the Annual Reports, as well as in the pages of the *Indian Forester*. In 1883, I had before me the excellent valuation surveys made by Mr. Hutchins of the Casuarina plantations in the plains and of the Blue gum woods on the Nilgiris, as well as estimates which I had made of other woods on my journeys through Southern India. It has already been mentioned, that those data seemed to justify the assumption, that, while in the moist climate of the hills and on the sea coast, blue gum and Casuarina, if planted on a large scale, might yield, the one 6 tons, the others from 2 to 6 tons a year per acre, the woods in the plains at the bottom of moist valleys might yield 2 tons but that the yield of the whole of the tracts available for the production of charcoal would only amount to half a ton per acre. Beech woods in Germany, completely stocked, and well managed, have the following yield per acre on a rotation of 100 years, the produce of thinnings being included and all wood being reckoned down to 3 inches diameter.

Locality I class 8.7 Cub. M. per hect. or 124 cub. ft. per acre

III „ 5.2 „ „ „ 74 „

V „ 2.2 „ „ „ 31 „

corresponding to about $2\frac{1}{2}$, $1\frac{1}{2}$ and 3-10th tons per acre. Without any certain data regarding the annual timber yield under real protection, of the woodlands available to yield charcoal for iron works in the Salem district, it is useless to speculate upon the area required to yield 20,000 tons of charcoal a year corresponding to my 80,000 tons of timber.

It cannot, of course, be expected that the forest officers of the Salem and other districts in the Madras Presidency should possess that knowledge of metallurgical processes, theoretical and practical, which would enable them to teach native iron smelters economy in fuel.

The circumstance that the proposal submitted in my Madras Report, to associate with the forest officers in this business, a Metallurgist with practical knowledge of charcoal iron making, has not been acted upon, should not, however, prevent action being taken as far as possible. My advice to all forest officers is to endeavour to do as much in this direction as possible and for this purpose to seek the advice and assistance of the officers of the Geological Survey, and of others competent to help them in this matter.

The question has already been raised, whether the importance of preventing the extinction of the native iron industry is sufficiently recognized. Howsoever this may be, eventually it is sure to be regarded as a matter of great moment, and those forest officers who have had the wisdom and energy to take action beforehand, will then reap the benefit of their foresight. These remarks must not be held to be limited to the Salem district. On page 151 of my Madras Report will be found an account of the iron industry in that portion of Bellary which surrounds the Sandur hills. At the time of my visit, in December 1881, 41 furnaces were at work in this portion of the district. A notice in Watt's Dictionary of Economic products, Vol. IV page 506 (1890) says that the native iron industry in the Bellary district had become nearly extinct. Should this really be the case, it would be a fact much to be regretted. From Ball's Economic Geology and from Mr. Holland's paper quoted above, it is evident that there is hardly a district in the Presidency without considerable deposits of workable iron ore. And in other parts of India there is abundance of rich and pure iron ore in many places. The remarks here submitted more or less apply to all provinces.

I must claim the patience of my readers for yet another project for turning to useful account the wood of the less valuable trees in India. Some of those old Coopers Hill Forest Students, who accompanied me on the Forest tour of 1888, may perhaps remember that on our way from the Spessart to Aschaffenburg we visited a large factory at Laupach, where beech wood is subjected to destructive distillation, the produce being charcoal and empyreumatic substances, chiefly acetate of lime and lead. This factory consumes 5,000 cubic metres (stacked) of beech wood annually and thus is a valuable customer for a portion, at least, of the immense quantities of beech wood annually produced in the Spessart. Besides acetates, there are other products of the destructive distillation of wood in retorts and close ovens, which have a certain market value, and which may, perhaps, some day lead to the establishment of such factories in India. A cubic metre stacked of beech wood, air dry, which weighs 500 kilo. (35 cubic feet,

weighing 1,100 lbs.) if carefully treated in retorts, yields the following products :—

- | | | | |
|-------------------------------------------------------------------------------------------------------|-----|-----|----------------------|
| 1. Charcoal | ... | ... | 100 kilo or 220 lbs. |
| 2. Pyroligneous acid, which,
by the addition of chalk is
converted into grey calcium
acetate | ... | ... | 25 „ „ 55 „ |
| 3. Wood Naphtha (Wood
Alcohol) | ... | ... | 5 „ „ 11 „ |
| 4. Wood Tar | ... | ... | 15 „ „ 33 „ |

The rest, less the weight of chalk added to make calcium acetate (2), consists of water and gaseous products.

Grey calcium acetate is used in dyeing and to manufacture other acetates mostly used for the same purpose. The present market price of this article delivered at a seaport in Germany is 18 to 22 marks for 100 kilos. Wood Naphtha is used for dissolving resins and for other purposes. Under good arrangements the fluid obtained by the process contains, in 100 volumes, 90 Methyl Alcohol 100 per cent, and the present market value of Methyl Alcohol thus obtained is 80 to 90 marks for 100 kilos. What here is called 100 per cent Methyl Alcohol, contains 80 per cent of the pure substance $\text{CH}_3(\text{OH})$ mixed with about 10 per cent Aceton ($\text{CH}_3 \cdot \text{CO} \cdot \text{CH}_3$) and 10 per cent of various other substances. These two substances will probably in India command a similar market price as in Germany. That mentioned under No. 4, wood tar, is likely to acquire special value in India. By the distillation of wood tar more pyroligneous acid is obtained, and from 35 to 40 per cent of wood-tar oil, a substance with powerful antiseptic properties. This wood-tar oil would, in the opinion of persons competent to judge, be an excellent article for impregnating woods in India, so as to make them durable, that is to protect them against decay and the attack of insects. Wood Tar oil contains the true creosote originally so called, because it was used to preserve meat. What is now generally called creosote is a different substance, the correct name of which is Phenol $\text{C}^6\text{H}(\text{OH})$ or Carboic acid. It is prepared from Coal Tar and is the substance used to impregnate timber in Europe. In the creosoted sleepers, which are imported into India, phenol is the antiseptic substance. Wood tar oil has also been used with success for impregnating timber in Europe. Indian mineral coal is, I understand, not sufficiently bituminous to yield phenol on a large scale, hence, in order to impregnate timber in India with the so called creosote, this substance would have to be imported from Europe. It might possibly be more economical to employ wood tar oil, which contains the true creosote.

In Germany similar results are obtained from the wood of oak and birch, that of oak yielding a little more wood naphtha and pyroligneous acid. The wood of coniferous trees on the other

hand, spruce, silver fir and Scotch pine, yield equal quantities of charcoal and wood tar, but much less pyroligneous acid and wood naphtha. It is probable that similar results will be obtained in India, and that, as far as pyroligneous acid and wood naphtha are concerned, the destructive distillation of the wood of broad leaved trees will be more profitable than that of the so-called inferior pines. I would, however, draw special attention to wood tar oil for the impregnation of timber. On the assumption that, broadly speaking, Indian woods will yield the same quantity of wood tar as is obtained by the destructive distillation of beech wood, 1,000 lbs of timber may be expected to yield 12 lbs tar oil, a substance which can be used for impregnating the wood of the less valuable pines of the Himalaya.

I have before mentioned the utilization of some of the beech wood of the Spessart hills, through the operations of the factory at Laupach. In old days, the beech wood was utilized in a much more simple manner. The oak timber of the Spessart has from time immemorial found a market in the manufacture of staves for wine casks required for the wine districts in the Rhine and Main valleys. In those days no roads existed in those hills, the oak staves were split on the spot and were carried on mules or on men's backs. In most places, beech was then, as it is now, associated with the oak, and to this mixture the splendid growth of the oak on the poor sandstone soil and in the severe climate of the Spessart must be ascribed. Utilization of the beech timber by export was out of the question; it was however utilized on the spot on a very large scale by glass factories and for the preparation of potash. The procedure certainly was most wasteful. The beech trees were burnt, glass was made with this potash and the sand, which here was everywhere found on the spot. Where the forest in one locality was exhausted, the glass works were shifted to another place, and the work of destruction was commenced afresh. It was a system which somewhat resembled the shifting settlements of Karen *Toungya* cultivators: and the denudation of the soil, the result of this forest destruction, has, together with long continued practice of removing litter from the ground, had the effect of impairing the productiveness of the soil, particularly on the outskirts of the Spessart and in the northern more densely inhabited portion. To some extent, however, this wasteful system gave room to the oak and thus contributed to the maintenance of this, the more valuable tree in the Spessart, the only one, the timber of which paid for carriage over great distances and hilly ground in the absence of the present splendid system of roads.

What I have permitted myself in the preceding pages to set before my younger friends in India, will enable them to understand why, on the autumn forest tours which I had the honour of making with the senior Coopers Hill forest students, I made a point of showing them, not only the Laupach factory here mentioned, but

also the establishments for impregnating timber with antiseptic substances at Zurich and elsewhere, the wood pulp and cellulose factories in the Black Forest and the large charcoal iron works at Lenbach in the Tirol. For a forester in India, a knowledge of chemistry is even more necessary than for a forester in Europe. All these proposals for utilizing the less valuable kinds of timber are based upon processes of a chemical nature, and though it cannot, of course, be expected, that the forester should be competent to establish factories like those mentioned, he ought to be sufficiently familiar with chemistry, to form a judgment regarding the expediency of establishing work of that character in any given locality. The subject which in German Forest Schools is taught under the name of "*Förstlich-Chemische Technologie*" is even of greater importance for Indian foresters than for those employed in Germany.

Those who were in the Indian Forest Service in 1878, when I succeeded in getting the Dehra Dún Forest School established, may perhaps know, that the School was established in the teeth of long continued and powerful opposition. In the end, its establishment was only sanctioned on my assurance that the expense of the school would be covered by the increased income which would result from the more efficient management of the School forests. Yet under those difficult and straightened circumstances, I thought it right to insist upon the establishment of a Chemical Laboratory at the School, so as to enable students to become familiar with certain branches of Chemistry in a practical manner, by working with their own hands. Circumstances, I understand, have put an end to this most useful arrangement. This, I think, is to be regretted, because chemical analysis, more than almost any other occupation, is calculated to sharpen the powers of observation, and to develop the habit of drawing conclusions from observed facts. Chemistry, apart from its showing the way towards a more profitable utilization of woods, which cannot be advantageously employed in construction or otherwise, is an excellent preparation for all practical pursuits which are based upon natural sciences, Forestry among the rest.

But to return to the utilization of the less valuable species. I am a little afraid, lest my anticipation of an inconveniently superabundant production of these trees through efficient protection of the forests, particularly against fire, may not have been altogether premature. I fear it is a fact, that the difficulty of utilizing the less valuable woods has not as yet been felt to the extent which I anticipated, when the effect of fire conservancy made itself felt in the Central Provinces, in North Western India and in Burma. And I apprehend, that the conclusion I must draw is, that improvement in the condition of the forests has not progressed as rapidly as I had anticipated. Should this be the case, then some of the suggestions which I have submitted in

this paper, must wait, until a portion at least of the reserved forests have grown into compact and dense masses of wood.

I have before drawn attention to the analogy existing between the less valuable woods in India and the beech in Germany. Fortunately, it is now an accepted rule of silviculture, in Prussia, in Bavaria and in other States of Germany, that when beech forests are regenerated, a proportion of other more valuable trees must be introduced ; and that, where this practice already exists, the proportion of the more valuable kinds must be increased. Acting upon this principle, the oak, and in places the ash and maple, are sown or planted, where climate soil and other circumstances are favorable. Where this is not the case, conifers, the larch, the spruce, the silver fir and the Scotch pines are introduced. For maintaining the productiveness of the soil, the beech is most useful, but the money yield of the extensive beech forests in Germany is diminishing and this it is desired to prevent by associating with the beech some of the more valuable species. It goes without saying, that in India also the aim must be to increase the area stocked with teak, deodar and other valuable trees, where circumstances may permit of this being done.

The last remark I can imagine, may possibly be the only one that will commend the assent of some of those, who have had the patience to read this, I regret to confess, lengthy paper. Replace the inferior woods by those which are valuable, this I hear my critics exclaim, is the only sound and practical plan to follow.—Eradicate and extinguish the inferior woods and replace them by teak, deodar and other valuable kinds, is, however, easier said than done. And were it done, were pure teak forest, for instance, raised without bamboos and other companions, which tend to favour the growth of teak, as beech or silver fir favour the growth of the oak, the result would not be satisfactory.

Others again I hear object, that the questions here raised are altogether premature ; that under existing circumstances in India, the reserved forests cannot possibly form dense compartments like the forests in Europe ; that though fires are excluded, cattle keep down the young growth ; and that with the increasing population in the vicinity of the forests, uncontrolled cutting and lopping continues as heretofore. To this, I reply that the key stone of forest policy in India, concentration of efforts upon limited areas, seems somewhat to have been lost sight of. I have no doubt that there are, in every division, nay, perhaps, in every range, blocks which can not only be protected against fire, but can be closed completely against cattle and irregular cutting. The improvement which is sure to take place in these blocks, will pave the way for the good management of the remainder. If this principle is generally acknowledged and steadily acted upon, the question of utilizing the inferior kinds must sooner or later arise, and it can only be dealt with by action in the direction here indicated.

So far, some of my readers may go with me, but they are startled by the hint, that in these matters, it is for forest officers to take the initiative. They would prefer to wait, until they received distinct instructions from government, to arrange for the supply of wood, so as to prevent the extinction of the native iron industry, to establish factories for the manufacture of wood alcohol, calcium acetate and wood tar oil, to make wood pulp and to arrange for the impregnation of the inferior pines. Perhaps I may be able to set at rest the doubts of some of these anxious minds by mentioning a few facts from my own experience in the Indian public services, which tend to show, that under certain circumstances, it is the duty of a public officer to stick to a certain line of action, as far as such is compatible with the obedience, which every public servant owes to the Government he serves. Such firmness, however, is only justified by the conviction that the line of action maintained by him will promote the prosperity of the country and will secure the well being of its inhabitants. And, as a matter of course, success in such cases is impossible, where the line of action is dictated by selfish motives.

Soon after landing at Calcutta in December 1855, I had the honor of explaining to Lord Dalhousie, the then Governor-General, the outlines of the first measures which I proposed to take in order to place the management of the Pegu Teak Forests upon a permanent footing. He listened with great attention, and when I had concluded, he fixed me with his piercing eyes and said :—
“ Dr. Brandis, if you succeed in carrying out these excellent plans, ‘ you will confer a lasting benefit upon the people of Pegu. I hope ‘ you may succeed, and you will have my full support in the ‘ matter. I hold it to be the duty of the Government of India, to ‘ preserve the forest resources of Pegu, and not to allow them to be ‘ wasted, as the forest resources of other provinces have been wasted. ‘ Unfortunately, I must leave India soon, but I trust that my ‘ successors will take the same view as myself of the Pegu forests. ‘ Should it, however, thus happen, that at any time the Government ‘ of India were not fully alive to the necessity of preserving the ‘ forest resources of Pegu, I hope that you will remember what I ‘ have told you.” Lord Dalhousie left India in March, 1856, and died in 1860.

The measures which, under the orders of Major, afterwards Sir Arthur Phayre, I introduced in Pegu, gained for me the confidence of the Karen and other inhabitants of the forests, for I gave them profitable employment under Government in the working of the forests, and thus made them my allies instead of enemies in regard to forest protection. The merchants of Rangoon, on the other hand, soon commenced a vigorous opposition against the system introduced by me. Personally, I made a point of keeping on good terms with them, and they tried hard to persuade me to allow them to cut the mature timber standing in the forests. With

much show of reason they contended, that ships built of wood would soon be a thing of the past, that iron would, in ship building, as well as for all other purposes, replace the use of wood. At that time, the Sepoy mutiny of 1857 had saddled the Government of India with an enormous debt, and the disturbed state of the country had diminished the revenue from many sources. Under these circumstances, my friends urged that the only proper course was to take advantage of the high market rates of teak then ruling and by the sale to them of all the mature standing teak timber, to realize large sums, and thus to create an immediate source of revenue. More than this, the impulse which a business transacted on so large a scale would give to the prosperity of Rangoon imperatively demanded the acceptance of their proposals. They appealed to my devotion to the interests of the Government which I was serving, to my ambition and to my common sense, and they pictured in the darkest shade the disastrous consequences of a refusal to back their proposals. Within a few years the demand for teak would diminish, prices would fall, and in the end teak would be a drug in the market and the teak forests would be valueless.

When my friends found that I remained firm, and that Major Phayre, the Commissioner, refused to yield to their representation, they went to Calcutta, and, backed by the influence of the large and powerful mercantile firms of Calcutta, they succeeded in inducing the Government of India to order the Commissioner to throw open the Pegu forests to private enterprise. The orders were sent to Rangoon in February, 1831. These orders had to be carried out, but fortunately we were not required to throw open the whole of the forests at the same time. Nor were we required to make arrangements for more than a limited number of years. By that time, incessant hard work from 1856 to 1861 in examining the forests by means of linear valuation surveys, and by constant height measurements, had taught me which districts were valuable, and which were less so, and this knowledge enabled us, the Commissioner and myself, to frame a good plan of operations. The forests west of the Irawaddi river which, though very extensive, were the least valuable, were given upon 12 years' leases with the permission to girdle. In the eastern Prome forests, those on the Hline river in the Rangoon district and those of the Sitang valley, permits, in some cases for 3, in others for 6 years, were given to cut the timber girdled by the forest officers, so that the power over the green standing trees was reserved to Government. The forests on the Zamayee and Paunglin areas and those in the Tharawadi district, which were the most valuable, were for a time retained in the hands of Government.

In November, 1861, the proceedings of the Government of India were reported to the India office. Here a different view of the matter was taken, and the disastrous effect which these measures must have upon the forests was at once recognised. In a

remarkable despatch of 24th March, 1862, which is published in a Parliamentary Blue Book on East India Forest conservancy of 1871, the Government of India was requested to reconsider matters. Thus the Tharawaddi and Zamayee forests remained in the hands of Government. In the other forests, the leases and permits, which had been given in 1861, had of course to run their course, and in some instances they were afterwards renewed, but in the end the whole of the forest came back under the control of the Forest Department.

The wording of the permits, under which the Sitang and other forests were made over to the large mercantile firms of Rangoon, had been framed with the greatest care, yet the foresters employed by the permit holders commenced girdling and cutting green trees on a large scale. This necessitated legal proceedings, which led to the discontinuance of the system. In my Report on Forest Administration of British Burma for 1861-62 page 37, after giving a brief account of the action taken in obedience to the orders of Government, I had justly observed, that the conservancy of forests under the permit system is secured by written documents only, while in forests, worked on Government account, the forest department remains in actual possession.

It is the peculiarity of forest management, that trees require a long time to come to maturity, and this circumstance imposes upon foresters the duty of looking ahead, and carefully considering the future prospects of their charge. Upon them, therefore, in the first instance, devolves the duty of taking the initiative in all important matters, as far as such may be compatible with that loyal obedience which they owe to the Government they are serving. What I have here related concerning the first period of my public career in India, may, perhaps, serve to illustrate what I meant to impress upon those foresters in India, who have at heart the progress of the magnificent British Indian Empire and the well being of its inhabitants.

D. BRANDIS.

The Hill Forests of Java.

(A translation from the *Förest und Jagd Zeitung*.)

These forests may be conveniently sub-divided as follows :—

1. The moist forest between 2,000 and 5,000 feet elevation.
2. The forest in the cloudy region between 5,000 and 8,000 feet elevation.
3. The vegetation on the summits of the mountains over 8,000 feet elevation. These headings will be again sub-divided, if necessary, by the position of the forest in East or West Java.

(1.) THE FORESTS BETWEEN 2,000 AND 5,000 FEET.

The forests at an elevation of from 2,000 to 5,000 feet are those in which the rainfall, at least during the north-west monsoon, is greatest. Above 6,000 feet, the moisture-laden winds do not blow, and at 5,000 their effect is much reduced, although occasionally the highest peaks are hidden in clouds. The virgin forest, which originally covered this region, has been already seriously interfered with ; at the lower elevations, coffee is grown and in the higher localities cinchona is cultivated, but in places types of the natural forest may still be seen. The moist forests of Java contain the largest tropical growth, it is here that a luxurious vegetation is enabled to flourish owing to the advantages both in moisture and in temperature. In comparison with the forests of Europe, the density is less and this is accounted for by the excessive production of foliage in contradistinction to that of timber ; climbers which, of all forms of vegetation, are the most dependent on heavy rainfall, attain enormous dimensions and seriously affect the density of the forest. But even the trees themselves bear the impress of excessive moisture in the peculiar buttresses, which are absent in the drier regions, but may be taken as characteristic of the forest growth where heavy rainfall is the rule. Epiphytes also, which are common in this region both as shrubs and trees, chiefly Ferns, *Medinilla*, *Fagraea*, *Sciadophyllum*, and *Rhododendron*, are a form of vegetation which cannot exist without moisture ; and finally, the size of the leaves is dependent on the quantity of moisture for in no other region are the leaves so large as in this moist zone, although they do not attain such remarkable dimensions as in the damp forests of the Brazilian coasts.

The forests in the moist zone contain both the true tropical species which are common throughout the island and the more temperate species such as *Amentaceae*, Conifers, *Laurineae*, and *Ericaceae* ; but these latter are generally found only in the more elevated portions of the zone. *Altingia excelsa*, with a stem of often 100 feet high, towers above the other forest growth, with its

branches hung with moss and adorned with the crimson flowers of *Rhododendron javanicum*. The more common *Gordonia Wallichii*, though a smaller tree, is no less striking on account of its constantly renewed large white blossoms which remind one of the tea flower. The various species of fig, recognizable from their aerial roots, are frequent in this region; as well as other trees which, similar to some kinds of fig, bear blossom and fruit on their stems. The *Meliaceæ*, *Magnoliaceæ* and *Anonaceæ*, the last two being chiefly represented by climbers, show this peculiarity in flowering. The observer, however, cannot always without felling the trees determine with any great accuracy the nature of the leaf canopy; but it is believed that the highest trees of this region belong to the following species, Ferns, *Canarium*, *Thespesia*, *Dipterocarpus*, *Epicharis*. The smaller species are much more numerous and belong principally to the families *Myristicaceæ*, *Tiliaceæ*, *Sapotaceæ*, *Rubiaceæ*, *Euphorbiaceæ*, *Byttneriaceæ*, *Lauraceæ*, *Mimoseæ*. The numerous climbers are as difficult to identify as the trees unless they have some characteristic such as the oval excrescences of *Vitis pubifera*, or the thorny hooks of *Uncaria*, or the stem blossoms of various *Anonaceæ* and *Magnoliaceæ*. Of Epiphytes, the larger varieties have already been mentioned; of the smaller are orchids and *Aeschynanthus* especially common, as well as ferns, *Asplenium*, *Platynerium*, etc., and *Lycopodia*; the last often hanging from the branches in festoons over 3 feet long.

But the epiphytic vegetation is not so rich in Java as in Brazil or in the Antilles owing chiefly to the absence of *Bromeliaceæ*. The dense undergrowth comprises a bewildering admixture of species; *Urticaceæ*, *Piperaceæ*, *Myrsinæ* are very numerous but not otherwise remarkable; but the coral red inflorescence of many bushy shrubs of *Pavetta* strikes the eye at once, as well as the orange flowers and large white calyx of the *Mussaenda*. Other *Rubiaceæ*, like the violet flowered *Lasianthus*, are distinguished by the disgusting odour given out when the leaves are bruised. There are a few small palms (*Pinanga*) and tree ferns (*Alsophila*). But the most remarkable part of the undergrowth consists of giant monocotyledons (*Musa*) which are never found in flower or fruit; besides *Zingiberaceæ* (*Alpinia*, *Elettaria*, *Costus*, *Zingiber*, *Hedy-chium*, etc.) These species of *Zingiberaceæ* which frequently attain a height of 12 or 15 feet, form small clumps under which few other species can exist. Between the dead leaves which cover the ground may be seen the red and yellow inflorescence of *Costus globulus* and various kinds of *Elettaria*; other similar flowers are almost hidden in the soil, whilst stretched out in the shape of a star the open fiery red blossoms of *Elettaria coccinea* may be observed. In some of the varieties of *Zingiber* the flowers are spiculated or stalked. All these flowers are shiny and often half rotten, similarly to the epiphytic *Bromeliaceæ* of Brazil.

It is not possible to treat of the lower vegetation, grasses, etc., but, as a rule, the soil between the shrubs and clumps of superior

vegetation is covered with a carpet of herbs chiefly of the following kinds, *Urticeæ*, *Cyrtandra nemorosa*, and ferns, whilst *Begonia robusta* is also common ; springing from this level green covering taller shrubs are noticeable, such as *Polia thyrsiflora* with its cobalt blue fruit and its white blossoms ; *Dianella montana* with similar colouring of fruit and flower ; *Disporum multiflorum* with its hanging bells of violet ; *Polygala venenosa*, etc.

If the leaves of this miniature forest are drawn to one side, the brown, damp and half rotten humus is visible. The space between the shrubs and herbs is great, although from above the soil appears to be well covered ; yet small plants, moss, etc., does not grow, neither are ground orchids remarked ; and yet one is surprised to observe under the leafy canopy the large white blooms of *Cyrtandra nemorosa* which spring from the base of the stalks of this plant. Where the stems of the *Saurauja cauliflora* are visible, the large white and red blossom which springs from its base is often hidden by the dense leaves of *Elatostema* and *Cyrtandra* and, under this shelter the insect life supported by these blossoms may be seen.

It is evident from the observations made that the forests of the moister zone, although they do not possess so high a temperature as those of the plains, yet, in their systematic composition, show a thoroughly subtropical character, whilst various characteristics such as buttressed stems, large climbers, woody epiphytes, etc., peculiar to regions possessing a large rainfall, give to them many of the traits of moist tropical regions.

(To be continued.)

Protected Forests.

It was very gratifying to find an answer to the article on Protected Forests in the August number of the *Indian Forester* from so able an authority on the subject as Mr. Baden-Powell: anything from his pen is always important. He admits that the article in the main justly supports the point contended for, which being the case, nothing more need be said, affecting the particular issue, as no question of rights are at stake: none were ever awarded on these ever-changing areas and never will be, it is imagined, although a Forest Settlement Officer once *did* endeavour to grant certain rights; but his decisions were without the slightest difficulty upset on appeal. Concessions innumerable, however, have been given, which cause, it is thought, almost as much trouble as rights; and in this connection Mr. Baden-Powell's remarks at page 146 of Volume XVIII of the *Indian Forester* are worth a persual.

The award of concessions wholesale in localities where a Working Plan has to be enforced, only brings the Forest Department into disrepute with the people, and the Revenue and Forest Officers into conflict.

But, wherever the locality be, forests when placed under systematic treatment and especially where numerous concessions have been awarded, are bound to be the cause of a certain amount of discontent and dissatisfaction which must be put up with.

Circumstances now can scarcely be as they were 50 or 60 years ago when the country possessed no railways and no large industries. Cultivation was then very limited and the population sparse : cattle were allowed to graze at will, and the people to remove what was wanted from the jungles without restriction.

As they had been accustomed to this hand to mouth policy for so long remonstrance naturally came when the old habits were suddenly arrested ; but habit is overcome by habit as a great worthy has said and the habit of economy and self denial must be inculcated into them, if it be required to retain forests permanently and if the existence of future generations is not to be jeopardized.

It is only where forests are administered in a haphazard and lax manner that perfect tranquility prevails ; instead, therefore, of being satisfied with the condition of things in such localities, it behoves the Government to look into them and ascertain how things are progressing. The idea which exists in England, and in the minds of many, that the annual yield only, and not the forest capital in India is being exploited everywhere, is, it is thought, rather incorrect. Several places may be named where all is confusion and where valuable forest property is fast disappearing for want of a Working Plan. A great stride toward betterment has been made during recent years, it is true ; but the progress is slow, and without a larger establishment and more expenditure, some of the valuable state property will be found to have disappeared by the time a working scheme has been introduced. It is not intended to bring a charge of neglect against any individual or body of individuals with regard to the manner in which many Districts are administered ; the real facts are that Districts are too extensive and the executive duties of a Divisional Forest Officer are so heavy that time does not permit, nor does the establishment at command enable, a Working Plan to be even started. But to return to the question of the forests on the alluvial lands which were alluded to in the April (1893) No. of the *Indian Forester* ; and whose character was assumed to be temporary another aspect of the question has revealed itself with regard to them when judged in conjunction with proprietary right in the soil which rather disturbs the original theory and justifies their claim from a forest point of view to be considered permanent. The forests on these lands, it will be remembered, are all reserved under Act VII of 1878 ; and as property right in the soil exists down to the centre of the earth would

any washing away of land, *i. e.*, change in the river's course, interfere with the right of the Forest Department to the land alleged to be removed? As explained in the article, a forest has been known to exist on one side of the river and Government waste or Zemindari property to be on the opposite bank. The river suddenly changes its course, and flows *over* the forest property, cutting off as it were a slice and leaving an addition to the property opposite. According to the rules in force, the Forest Department loses the land cut off; but is this legal? The land below water and the portion above on the opposite side, up to the extent of the area gazetted, is apparently *still* forest property, the water merely being an accidental or temporary surface covering for a few seasons.

In like manner, can an addition to the forest area result by the action of the river? Any addition to a properly constituted Reserved forest cannot be made, legally speaking, except by notification in the Gazette, nor can any exclusion be permitted except with the sanction of the Government of India. Year after year, however, administration reports are reviewed by Government with these changes shown, yet no notice has been taken of them. It sometimes happens that a forest gazetted as Reserved disappears entirely, as was the case with one of over 1,000 acres which was constituted in 1878. A map of the forest may be found in the Divisional forest office and its position on the river bank is defined on all the old maps of the Taluka. Year after year the river crept further in, until at length the whole area disappeared.

Shortly afterwards it began to retire towards the opposite bank again, leaving alluvial land where forest property originally existed; but there being no mark nor indication of any sort to identify the former existence of any forest, the new deposit was claimed as an accretion to the village lands adjacent and accordingly the forest became permanently effaced. The re-formed land may be said to be merely a deposit on the surface of what was once reserved forest; but according to existing Rules the forest is gone for ever. If, as already stated, proprietary right in the soil exists down to the centre of the earth, cannot the Forest Department claim the new deposit by taking measurements and laying down the boundaries as originally demarcated even though there be no sign of any former boundary marks? The question as now briefly explained, was advocated recently by a very capable member of the Civil Service and one who possesses considerable knowledge of Forest Settlements; and it has such an important bearing on the constitution of Forests in localities similar to the one under reference that it would be interesting to have an expression of opinion from Mr. Baden-Powell on the subject, if he will condescend to offer one.

G. E. M.

II.—CORRESPONDENCE.

Tour in Jaunsar.

SIR,

I have read with interest Mr. Fernandez's criticisms on the Forest School tour notes for July and August 1893, and beg to forward a few remarks on the matters referred to by him.

Your correspondent enlarges upon the "generally unsatisfactory results of the Jaunsar Deodar plantations" but in this respect, I think any one who has examined, in detail, these plantations; compared them with other deodar plantations elsewhere; and also considered their cost, will agree with me that Mr. Fernandez is labouring under a mistake. I admit that his disparaging remarks apply to such places as the bare slopes of Bodyar and Korwah, where the natural conditions are most unfavourable for the growth of deodar, but I think every one will admit that some of the older plantations such as Konain, Koti Kanasar, Deota and Lorli are as successful as could be expected.

The comparative cost also of these plantations should be considered, as they have in no case exceeded Rs. 30 to Rs. 40 per acre, whereas, I understand, the successful plantations Mr. Fernandez refers to elsewhere, have cost at least Rs. 100 per acre, which makes a considerable difference.

I quite admit the truth of Mr. Fernandez' remarks about the great advantage of using good strong nursery plants, especially when the conditions are not very favourable, always provided they can be handled properly by skilled workmen. It, however, often happens that at the critical time when the planting has to be done, one is obliged to employ ordinary untrained coolies, who invariably cut or damage the big roots and the result is eventually much less satisfactory than if smaller plants had been used.

Under the circumstances, therefore, it has been customary in Jaunsar to use plants varying from 12 inches to 18 inches high, which dimensions are usually attained by plants growing in favourable nurseries is about $2\frac{1}{2}$ years.

The following is a statement of the progress and treatment of the young plants in the nurseries previous to planting out in the Forests.

The seed is sown in November and germinates in the following March and the young seedlings are pricked out in the nursery beds during July, 6in. \times 7in. apart.

These seedlings are again pricked out during the following July, 9in. \times 6in. at which time they are 16 months old.

During the following July or when the seedlings are 28 months old, most of the plants, if grown in favourable nurseries, will have attained from 12in. to 18in. in height, and are then considered fit for planting out in the Forests.

All plants which are not vigorous enough for planting out are again transplanted and left for another year in the nurseries.

As regards the planting out of basketted plants, I explained the method in a recent article in the September number of the *Forester*, and from that letter it may be seen that the average age of basket plants when put out in the jungle is two years.

Under the circumstances, therefore, the writer of the School tour notes was not far wrong in his statement that plants "about (not "only") two years old, were ready to be put out in the Forest." Of course, I am willing to admit that good 3 to 4 year old plants, if planted out carefully, will give better results than $2\frac{1}{2}$ year old seedlings, but taking into consideration the chances of damaging the roots of big plants, and the extra cost, I think that after all, the smaller plants, if vigorous, are probably the best to use on a large scale.

Regarding your correspondent's observations about the failure of blue pine plantings, perhaps it will interest him to know that we have tried large kail plants also with unsatisfactory results. The fact is that blue pine has got very tender rootlets and is not suitable for rough treatment by unskilled workmen; and probably, after all, sowing "in situ" is the best method for the propagation of this species.

Regarding your correspondent's concluding remarks about the probability of blue pine seeds having been carried to Lorli from Matkangra, through the agency of birds, I have carefully considered the matter, and think there is a good deal to be said on both sides of the question.

In the first place it should be noted that the heights of Matkangra, from which the seeds are supposed to have come, are not more than $1\frac{1}{2}$ miles distant and possibly there were several trees nearer at the time the Cantonment was started. Again, it does not seem to me to be very conclusive evidence that because the jungle crows referred to shewed a decided partiality for gnawed chicken bones, that they would take the trouble to carry kail seeds in their beaks all the way to Lorli. In my opinion, it is more likely that the seeds might have been deposited by Himalayan nutcrackers or chir pheasants who feed greedily on blue pine seeds, and might, therefore, bring them from a great distance. It is nevertheless a well known fact that winged seeds are often carried long distances by the wind, but after what has been said above, I am rather inclined to attribute the appearance of blue pine seedlings in the Lorli Block to Mr. Fernandez's bird theory.

E. Mc A. M.

NOTE.—We confess to believing ourselves, that the wind theory is the most likely one. And, as regards transplants, it is not a question of *age* at all, but of *size*: it we can get big enough plants at two years of age, we certainly ought not to wait till they are 5 years old before planting out in order to carry out a theory.

HON. ED.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Usar Reserves at Cawnpore and Aligarh.

The following report was recently drawn up by Mr. J. F. Duthie, Director, Botanical Department, Northern India, as the result of a visit to the Usar reserves at Cawnpore and Aligarh. Mr. Duthie's conclusion that the importance of protection has not been sufficiently appreciated, is only a confirmation of the views which find expression in the Government of India Resolution No. 16A, March 1st, 1883, on the injury done by cattle and goats to the grass lands of the country. In this Resolution it is stated that "In the North-Western Provinces various experiments have been, for three years, conducted by the Agricultural Department, with the view of reclaiming *usar* or *reh* lands. It has been found that the simple expedient of enclosure is more efficacious than any other operation. The natural grasses which, so long as the land is accessible to cattle and goats, are nibbled down as fast as the young shoots appear, spread in the enclosed areas at a rapid rate over the worst land. After two years, experimental cuttings gave a result of 20 maunds of good hay per acre—an outturn which, on a square mile, would suffice to feed 1,000 cattle for three months, exclusive of the bushes and trees which, there is good reason to believe, can be grown when once the grass is well established.

Juhi (Cawnpore).—A careful examination of the grass vegetation in the experimental plots, gave evidence of still further improvement as compared with results previously recorded. There are now very few bare-looking patches, and none can be found which are absolutely so. In fact, a large portion of this reserve may now be considered as practically reclaimed. Mr. Miller, Director of Agriculture, who is also of this opinion, intends, I understand, to have a portion of it broken up at once for cultivation.

In November 1891 I selected two of the plots (Nos. 39 and 49) for experimental sowings of certain kinds of indigenous grasses. The ground was prepared and the seed sown according to instructions given, but, as the water-supply failed, the results were also a failure.

Chherat (Aligarh).—As the cattle employed in connection with the Dairy Farm here have been allowed to graze over the greater portion of this reserve, the grass growth now appears very scanty compared to what it used to be. The question of grass

grazing in India requires, I think, more care and attention than it has hitherto received. In this country the indigenous grasses of pasture lands have a much greater struggle for existence than those of more temperate climates, as in Europe for instance. In the plains of Northern India the grass vegetation is exposed to alternate periods of extremes in temperature, and often to excessive moisture. The people of this country take no care about the preservation of pasture land. Their one idea seems to be to let their cattle eat up or tread down every green blade as soon as it makes its appearance, until at last nothing remains for them to eat. The tread of cattle is injurious at all times, but more especially when the young shoots are beginning to unfold. Reproduction is then literally nipped in the bud.

On the low-lying parts of the Chherat reserve, where the ground is under water for a considerable time during and after the rains, I found that the *bat* grass (*Diplachne fusca*), which thrives in such situations, had spread very much since my last visit. It is a good fodder grass, and should be encouraged.

The plantation of seedling Date Palms is doing fairly well but they still require attention, and should be watered occasionally during the hot season.

Gursikran (Aligarh).—The condition of the ground occupied by the experimental plots continues to show improvement as regards the extension of grass growth. Many spots, which five years ago, were absolutely bare and efflorescent, are now completely covered with grass.

The area containing the experimental plots was purposely selected in 1888 on account of there being included in it a large number of bare and efflorescent spots; there were also several patches of dub grass and other kinds, besides the characteristic usar grass; and extending through some of the plots there were several lines of depression acting as drainage channels, on the slopes of which dub grass was plentiful. The varied nature of the vegetation has, according to my observations, acted very materially towards bringing about the generally improved condition, year by year, of this portion of the reserve. The greater part, however, of the Gursikran reserve is entirely covered with the ordinary usar grass (*Sporobolus pallidus*) which grows excellently well, and produces heavy crops every rainy season. The uniform character of the soil over a large area, and the absence of competitive influence on the part of other kinds of grasses, tend to encourage the luxuriant growth of the usar grass, and those portions of the reserve which are thus exclusively occupied by this grass appear to me to be incapable of further improvement by means of protection alone.

As a fodder-yielding species this grass has not been fairly tested. It is said to be too coarse for making into hay, and certainly it is so when cut after the rains are over, which is the usual custom in this country. As it is known to be a good grazing

grass, we may presume that it is fairly nutritious. If, therefore, owing to damp weather during the rainy season, it cannot be made into hay at the time when it should be cut, it might be preserved in silos, as I suggested some years ago in the Introduction to my book on the Fodder Grasses of Northern India.

The ultimate aim, however, in all attempts to reclaim what is now uncultivable usar land is to render it fit for cultivation. The successful results which have recently been obtained at Cawnpore and Aligarh are encouraging; the ground at Amramau is now under cultivation; the greater portion of the Juhi reserve may be considered as practically reclaimed; and considerable progress is being made at Chherat. The area thus affected constitutes, however, a very small fraction of the three million acres waiting to be reclaimed in these Provinces.

There can be no doubt that, as a preliminary measure, the protection of waste usar land from cattle does wonders, and at the Juhi reserve it may be considered to have done all that was required. But in the case of extensive areas, the soil of which is uniformly bad, or where the vegetation is exclusively composed of the ordinary usar grass, some further remedy is needed to supplement the good effects of protection.

If expense were no consideration, the reclamation of reinfected tracts might be brought about speedily in a variety of ways. A thorough system of sub-soil drainage would probably have the desired effect. This idea was suggested many years ago, but I am not aware if any steps were taken to have it tried on a sufficiently large scale.

Another proposal was to cover the land with silt. This has been carried out with considerable success in certain localities within reach of canals, and with aid of water as a vehicle.

A more recent suggestion made by Mr. Gladstone, Deputy Commissioner of Umballa, is to plough into the reh soil a top dressing of river sand. Mr. Gladstone maintains that the sand will act beneficially on the soil as a dilutant; and so, by diminishing the relative strength of the noxious salts, a soil will be produced which will support vegetation, and lead ultimately to its cultivation. The cost of transporting the sand would, of course, be a heavy item but Mr. Gladstone is of opinion that results would more than cover expenses. An experiment on a small scale is now being tried at the Chherat reserve.

The demand for cultivable land will in time no doubt necessitate the adoption of more extensive measures for the reclamation of usar land, the costliness of which is at present the only real drawback. In the meantime, however, I would recommend the continuation of experiments with various plants such as are likely to thrive in reh soils. As a promising example, I would mention the *frásh* (*Tamarix articulata*), a common tree in the Punjab, where it thrives well on saline soils. It is easily propagated either from seed or by cuttings, and is a quick growing tree.

Sir D. Brandis, in the Forest Flora of North-West and Central India, page 22, says that the slender twigs are frequently hoary with saline efflorescence. He also mentions that the wood is strong and durable, and is used for making ploughs, Persian wheels, and other articles ; and that when well seasoned it makes good fuel. The bark is used for tanning, and the galls produced on the branchlets are employed as a mordant in dyeing, and also in tanning. The seed of this tree is obtainable during the rainy season. Two other species of *Tamarix*, viz., *T. gallica* (known by the name of jhau) and *T. dioica*, might also be tried. These latter are shrubs, and are found abundantly on moist alluvial lands, or on river banks ; they also appear to thrive in soil impregnated with salts. The lower and damper portions of the reserves at Gursikran and Chherat would probably suit them well. The seed ripens during the cold season.—(*Agricultural Ledger Series.*)

Forest Inspection Reports on the Districts of Salem, North Coimbatore, Anantapur, Bellary and Vizagapatam.

Mr. Popert's report on Salem, though short, is interesting, chiefly on account of the evidence it brings of the importance of substituting systematic working of even a temporary and rough character for systems of sale by permit, etc., which only tend to deterioration of the stock. This is what the Conservator says of the District Forest Officer, Mr. Brasier, in this connection.

" I was pleased with the strides made by your present District Forest Officer in this direction. He has opened coupes practically throughout the district, and the permit system is becoming a thing of the past. He deserves particular credit for the judicious manner in which he has effected the change ; during my tour I heard only one complaint which proved to be entirely unfounded, and which owed its origin to a contractor of adjoining zemin forests who, under the old system of indiscriminate felling throughout the forest, was most probably able to smuggle a considerable quantity of forest produce from Government Forests under cover of zemin permits."

The badness of the staff and its venality are the chief matters upon which the Conservator has remarked. It may be hoped that the effects of forest education may soon shew themselves, but Salem is, we should think, a difficult District in which to stop bad practices, which have probably gone on for several years.

The note on NORTH COIMBATORE, has some points of interest. First of all we reproduce Mr. Cherry's suggestion for the management of the Vellamundi Revenue on the Bhavani River which is a poorly stocked piece of forest, a good deal overrun with prickly pear. These suggestions are :—

‘ The reserve should be closed to permit-cutting.

‘ The avaram shrub should not be worked for three years.

‘ Cattle grazing should be limited to one head for every 5 acres.

‘ The reserve should be divided into blocks of about 1,000 acres and each year a block (beginning with the most easterly which should be taken up this year) should be operated on as follows :—

‘ (1) The prickly-pear must be extracted and either burnt, or used to temporarily fence the block.

‘ (2) All blanks must be run over with a plough and seeds of tamarind, turinji, *Albizia lebbek*, neem, satinwood, *Pithecolobium Saman*, avaram and any other suitable seeds must be freely planted in the plough furrows just before the rains.

‘ (3) The existing growth should be retained as shelter until the seedlings are sufficiently established, when

‘ (4) The existing growth should be coppiced under standards departmentally and removed with as little injury as possible to the seedlings.

‘ (5) The blocks that are thus being treated should be entirely closed to grazing and must be fire protected.

‘ If the District Forest Officer can manage a block on the west at the same time, so much the better, but as the growth on the west is very much better and there are few or no blanks, it may be possible to begin coppicing there at once and so provide any village fuel that may be necessary to make up the deficiency caused by stoppage of permits.

‘ The object is, to get the whole area re-stocked with seedlings and then the present pollarded growth coppiced so as to get a more uniform growth in as few years as possible.”

We do not quite understand (4) : is it meant that the whole forest is to be coppiced (it contains about 19,000 acres) in 19 years ? We suppose so, and if so we hope to find in future reports, accounts of the result. It seems doubtful whether it will *pay* but there can be no doubt as to its silvicultural advantage.

The Conservator recommends a hedge of the valuable Coimbatore hedge plant, *Balsamodendron Berryi* being planted by means of cuttings.

He very properly animadverts on the practice he discovered of keeping dynamite and fuses loose about the Divisional Office. Like Mr. Popert, Mr. Cherry is also anxious to introduce a ‘ coupe’ system of felling instead of sales by permit and we are glad to see that in this he is supported by the Collector and the Board of Revenue. North Coimbatore is lucky in being off the beaten track

and the Conservator can there carry out what would not be permitted by the amateur foresters in the adjoining District of Nilgiris.

The note on ANANTAPUR by Mr. E. D. M. Hooper, dated December 16th, 1892, is long and detailed, but there is little which is of sufficient general interest for our readers. The Anantapur District is a very interesting one in many ways to a Forester and the absence of more than a very scanty record of the improvement of growth of the forests seems a pity. Some of the Reserves were almost bare when taken up first and inspection notes ought to record the improvement in growth which is naturally more easily noticed by a Conservator, who inspects at intervals, than by a Divisional Officer who sees the forests frequently. The following, on *Hardwickia*, probably will, however, be of interest. "*Hardwickia* has made great strides since it has come under protection. The custom of pollarding the trees for the fibre of the shoots has been entirely stopped and the supply of seed has consequently been enormously increased. Judging from what I have seen, I imagine that germination of the seed follows very soon after its fall with the early rains, but that the young plants dug down to their roots for one, if not for several years, each season putting on a stronger growth, which eventually persists in asserting itself."

Mr. Hooper's note on BELLARY of January 1890, also contains very little of general interest, it is full of detail of more or less unimportant matters and the most noticeable thing is the recommendation bestowed by the Collector and Conservator on the native District Forest Officer, Mr. Nallasawmi Naidoo. It is disappointing to find no account of the progress of work in the Sandur leased forests.

In Mr. Hooper's note of January 6th, 1893, on VIZAGAPATAM there is also comparatively little of interest. It must have taken long to write, for it takes 26 pages of the Board's Proceedings, but the only extract we can find of any importance is the following, which Forest Officers in charge of Sal Forests in North India will be interested to read.

"*Natural Reproduction.*—The species we are most concerned with the reproduction of in the Vizagapatam district differs in the various ranges. In Palkonda it is the sal (*Shorea robusta*), accompanied, however, by other accessory species, some being so generally distributed as to be of distinct advantage or it may be harmful in their action, and, as an instance of the latter, I would mention that in parts of Palkonda the growth of *Lebedieropsis* is remarkable and apparently detrimental to the spread of sal, to the growth of which—always an interesting study—Mr. McArthur has already devoted some attention. It here appears as a sapling pole rising generally to 30 feet with a diameter of 5 inches, though occasionally found 40 feet high and 1 foot in diameter. The

‘original stools are still living in most cases and there is little or
‘no evidence in old stumps or pollarded trunks of the former
‘growth having assumed large dimensions. The sharply defined
‘limit of the local distribution of the sal is here quite as evident as
‘in Upper India where it often forms an almost pure regular forest
‘growth and apparently takes possession of abandoned cultivation
‘on the exact area of which it proceeds to rear an even growth
‘of coppice. Left to itself, the sal as a species tends to monopolise
‘the soil, and gradually the herbaceous growth below it becomes
‘reduced to a mere carpet of a few straggling annuals in which,
‘even grass grows with difficulty. As a consequence, the only fuel
‘to feed the forest fires is the carpet of fallen dry leaves and such
‘ringed and completely dead trees as are lying or still standing.
‘There is very little to entice animals to graze in ordinary sal forest,
‘and once the poles have asserted themselves and form canopy, the
‘presence of animals does but little harm. In the extreme youth
‘of the species it will be found, however, that cattle must be ex-
‘cluded and danger from fires most carefully guarded against.”

British Forest Trees.

We have received from the Author a copy of "British Forest Trees" by Mr. J. Nisbet, D. Œc., Deputy Conservator of Forests in Burma, an interesting treatise in which the leading principles of silviculture, as applied to the principal species of British forest trees, are ably set forth in a concise and readable manner. As the Author himself informs us in the preface, the work is not one of original research, but is to a considerable extent compiled from the best German Authors, to the information obtained from which, has been added the results of the Author's own personal observations and experience.

After a short introductory historical sketch of the forests and woodlands of Britain, the requirements of forest growth are then considered. The main portion of the book is then devoted to a description of each of the principal species of trees which form or are capable of forming pure forests. Each species of tree is systematically and separately described, its distribution characteristics and requirements as regards soil, situation, light, &c. being given, and also its peculiar liabilities to damage from external influences and disease. Its silvicultural treatment is then discussed at some length, distinction being made between the cases where it forms pure forest and where it is grown as the ruling species in mixed forest. The reproduction of the species both by natural and artificial means is also briefly considered.

* British Forest Trees by J. Nisbet, D. Œc. London. Macmillan & Co., 1893. 6s.

The latter portion of the book is devoted to the minor species of trees both indigenous to Europe and introduced, which do not usually form pure forests in Britain. Many of these are necessarily disposed of very briefly but a full description of the more important of them is given on the lines indicated above.

On the whole, the work is a well written one and must have entailed on the Author a considerable expenditure of time and labour. It might, perhaps, have been a little more conveniently arranged in chapters, but this, if a defect, is a minor one and we trust that "British Forest Trees" will receive the approval it deserves from all foresters and others interested in the growth and management of forests and woodlands in Britain.

Of course, as was to be expected of Messrs Macmillan and Co., the general get up, print and binding of the book are excellent and the price moderate.

VI.-EXTRACTS, NOTES AND QUERIES.

Afforestation in England.

A representative of the *Chronicle* recently had an interview with Professor Schlich, lately the head of the Indian Forestry Department, and now attached to the Royal Indian Engineering College at Coopers hill. Both Professor Schlich and his colleague, Mr. W. R. Fisher, are experts in the whole science of Forestry, and Dr. Schlich is the author of the valuable "Manual of Forestry" from which the *Chronicle* quoted the other day in suggesting a scheme of afforestation which would serve the purposes of adding to the national wealth, reclaiming waste land, preserving and adding to our national store of timber, saving a huge import from wood-growing countries, and at the same time securing work for the workless. Professor Schlich has been the subject of an interesting experience which throws a vivid light on the problems of Irish Government opened up by "X" in the *Fortnightly Review*. In the latter part of 1885, Dr. Schlich, in the course of a tour in Ireland, made some investigations into the possibilities of a scheme of afforestation for that country. The late Lord Carnarvon heard of them, was greatly interested, and suggested an interview. About that time, however, occurred the break-up of the Conservative Government, and the only result of Lord Carnarvon's overtures was the writing of a pamphlet, in which Dr. Schlich proposed the re-afforestation of waste lands as an adjunct to a general scheme of State purchase. Lord Carnarvon's successor took no notice of the suggestion, and Ireland was again left to sink more deeply into the morass of hopeless poverty.

As it happens, however, the problem in England is very nearly as pressing as that in Ireland. Dr. Schlich calculates that there are 26,000,000 acres of waste land in the United Kingdom, of which nearly 6,000,000 are situated in England. One-half of this could be profitably laid down in forest land, but the planting of 6,000,000 acres would suffice to replace our annual import of timber. The case is all the more urgent because, as Dr. Schlich pointed out to our representative, there is every probability that this supply will be greatly curtailed. Canada, for instance, is wearing out her forests and killing the goose that lays the golden eggs. However, nearly every country but our own is waking up to the necessity of economising its heritage of trees.

"Is it not true," asked our representative, "that we are practically the only country that does nothing for the preservation and extension of our national store of forests?"

"Well," said Dr. Schlich, "other nations are certainly waking up on the subject. The State is stirring in Belgium, which was very backward; and even in Russia, where forestry is still in the rough, progress has been made. In the United States there is a strong movement in favour of afforestation owing to the serious extent to which the timber is giving out."

"And what have we done?"

"Well," said Dr. Schlich, "we planted 14,000 acres of oak in the Forest of Dean from 1816 to 1825. But the thinnings have been too heavy, and the result has been that the trees have not attained a proper height-growth. Then we planted 9,000 acres outside Windsor Park about the same time. But Windsor has always been treated, not as a national forest, but as a royal shooting ground. Then there was a further plantation of 18,000 acres in the New Forest. But on the whole it is a fact that the old English forests are failing. It is useless for Mr. Auberon Herbert to speak of their æsthetic beauty and of the necessity of preserving them as they are, in order that ladies and gentlemen may paint them. Things have gone rather too far in England for that. My idea is that scenic beauty and usefulness might very well be combined in English woods. As things go, the forests are getting poorer and poorer, swamplier and swamplier, every year. In one particular, the soil becomes seriously deteriorated by the formation of what we foresters call 'pans.' In other words, the rain washes down particles of clay, which, mixing with the oxide of iron in the soil, forms a firm cohesive mass that has to be removed by iron tools. Much the same considerations apply to the great private forests. They are not treated on any regular plan. Now, the owner, wanting money, will order a wholesale clearance of trees; now again he will suffer whole forests to remain untouched for years. What these gentlemen, no less than the nation, want, is a systematic plan for dealing with forests on a regular system of thinning and renewal. Unless forests are so managed that approximately the

same quantities of material are brought into the market annually, it is hopeless to expect forest industries to spring up, and to realise good prices by the sale of the produce."

"As to the second point of my inquiry—is afforestation practical as a means of dealing with the problem of the unemployed? For instance, is it possible in winter?"

"Certainly," said Dr. Schlich, "you can plant trees all through the winter, save only when it is freezing. The principal work is, of course, the digging of holes for the planting, and that is clearly unskilled labour. In my 800 acres near Ascot, which I use for the instruction of my school, the labourers get 3s. a day."

"As to the cost of a larger experiment in forestry," added Dr. Schlich, in answer to further questions, "I have calculated that a return may be obtained from all kinds of land, and it comes out, reckoning every possible outlay, and including compound interest on the money invested, at the rate of about 2½ per cent. profit. As for the nature of the land which can be rendered profitable by afforestation, almost any kind is useful which can be obtained for £10 an acre, and that is always worth putting down in Scotch firs. To take one item alone, you might save the 70,000 tons of mining props which are every year exported from Bordeaux. There is no reason," added Dr. Schlich emphatically, "why every stick of these should not be grown at home. From the labourers' point of view, as I have said, the peculiar advantage of forestry work is that it can be done when no other work is available."

"You think then that an experiment in afforestation could very well be made?"

"Yes," said Dr. Schlich, "and though, of course, the exact return would depend upon the quality of the land, you could rely on some such result as I have indicated. The cost of planting would perhaps average about £6 an acre, £7 or £8 where there was a 'pan' and £4 or £5 where there was none. Supposing the nation laid out £60,000 for the purchase and planting of 7,000 acres, the work would provide labour, say, for forty days per acre at the slackest time of the year."

"As to organisation—what would you suggest?"

"I would say in general terms that it would be possible to associate an experiment of this kind with the office of the Commissioners of Woods and Forests, if not with the Agricultural Department. An area might be taken, say, a series of blocks, each extending to 2,000 acres, and an expert employed to draw up a plan of operations. The country has plenty of qualified practical foresters, and the planting might very well be done by them. The danger of failure would occur in the subsequent treatment of the woods. This could be provided against by instituting a course of schooling in forestry for land surveyors and agents. Perhaps this new school might be established in connection with the

Coopers hill College, which might very well institute a short course, hold technical examinations, and possibly confer diplomas. Or an efficient course might be established in connection with one of the agricultural colleges. Then, if the experiment succeeded, a specially qualified commissioner might be appointed to superintend the work of the growing department. That the culture of woods is profitable there can be no manner of doubt.—(*Daily Chronicle.*)

The Fall of the Leaf.

Mr. A. Ransom writes as follows in the *Bedfordshire Times*:—
The above title will suggest to many minds a kind of moralising that is the opposite of exhilarating. Indeed, I hold that the common sentiment connected with the fall of the leaf is false both in fact and taste. The fall of the leaf is no more a symbol of death than are any of the wonderful and beautiful changes that take place in the order of nature. A leaf is not a living entity—it is but a temporary organ developed for a definite purpose and for a definite time, to be dropped off when it has done its work for the plant that produced it. In fact—as I shall presently show—its fall is, to the twig on which it hung, rather a sign of life than of death. And then how beautifully nature effects this disposal of its no-longer useful organs! We have this year had an exceptionally brilliant example of this. It would be necessary almost to exhaust the artist's colour-vocabulary in order to describe the tints that our trees and shrubs, our trailers and our climbers, have lately assumed. Some golden leaves still hang on the poplars and limes, rich brown ones on the oaks and beeches, and the creepers on our houses still give us crimson and scarlet pencillings of every possible tone. The effect is heightened by the admixture of the so-called evergreens, which afford all shades of green as a kind of background against which the brilliant hues of autumn stand out in the most beautiful contrast. In passing, it may be remarked that these evergreens are in reality "evergreen" only in language. Their leaves do not last as long as the trees that bear them, any more than do the leaves of the trees whose boughs are now beginning to show graceful outlines against the crisp autumn skies. An "evergreen" is a tree that keeps each summer's leaves for two or more seasons, and thus, though it every year loses as many leaves as it produces, it always has one or more seasons' leaves upon its boughs.

In our climate the fall of the leaf is so conspicuous a stage in the year's plant life, that a brief explanation of the process by which it is effected cannot fail to interest even the least scientific reader. The process is simple and can be easily explained; and when understood it will show the reader that it is quite a mistake to look upon the fall of the leaf as an emblem of death. The change of season that accompanies it and makes it necessary may have some unpleasantness

connected with it in the minds of the infirm, the delicate, and of those who have allowed the errors of our modern civilisation to rob them of the healthy man's birthright of sympathy with nature in all her moods and phases. But this is quite another thing, and does not justify the sickly sentiment about autumn which I have mentioned above.

To understand the fall of the leaf, it is necessary to know, in the first place, that the leaf, when alive and performing its functions, is as intimately and organically connected with the twig as the arm of a man is with his body. The food, which it is the business of the leaf to manufacture, is conveyed from the leaf to the parts of the plant that need it, along channels that pass from all parts of the leaf into the inner structure of the plant. This can be proved roughly by trying to break off a vigorous leaf—the leaf does not easily separate from the twig at its point of juncture with it, any more than the arm of a man does from his body. But when the feeding season of the leaf draws to a close an organic change of beautiful simplicity takes place. Just where the leaf stalk leaves the twig, there is formed a thin microscopic layer of cork, right through the leaf stalk, cutting asunder, not only the soft matter of the stalk, but also the tough fibres that run from the leaf into the wood of the twig. Now, this thin film of cork possesses two qualities which enable it to effect its purpose at the place where it forms. It is impervious to water, and it is very easily torn. The cork layer being impervious to water; there can no longer be any passage of sap from the leaf into the twig, or *vice versa*. The leaf is no longer a part of the living system of the plant; and as it has no independent power of vitality, there is set up in it at once a fresh series of chemical and physical changes producing all those varieties of tint which make our trees so beautiful at this time of the year.

But this is not all. So far the leaf is still hanging upon the tree, though it is no longer a vital part of the tree. Receiving no supply of water from the tree, and losing by constant evaporation the water which it contained when the layer of cork was first formed, it dries up and both the blade and the stalk—and especially the stalk—shrink. The twig, however, does not shrink—if anything, it swells. Thus the end of the stalk, where the cork layer is formed, is strained. The stalk is no longer thick enough to cover the spot to which it is attached. Something evidently, must tear; the cork layer tears asunder, and the leaf falls.

Nor is this quite all. Were a man's arm to be torn off at the shoulder joint, there would be caused an ugly wound. So, if a green leaf is torn off in summer there is caused a wound in the twig, very different from the slight mark which is left by the falling leaf. If the simultaneous fall of the leaves of a tree in the autumn left the tree covered with ugly wounds on all its twigs, the tree would suffer very materially, perhaps die. But the use of the thin cork layer above comes in here again. It not only makes a clean cut through the fibres of the leaf stalk, but covers

the scar on the twig with a waterproof covering that prevents the outflow of sap from within, and protects the spot against injurious influences from without.

A simple illustration of the fact that such a change as that above described does take place, may be easily found by anyone walking among trees in winter. A little observation will be sure to discover a twig, broken in summer, but still hanging loosely to the tree. Such a twig will still have its leaves on it. They are dry and dead and curled up, but they still hang tightly to the twig. This is because the twig died before the cork layer was formed between it and its leaves. Thus it keeps its dead leaves as part and parcel of itself : while the tree on which it hangs has naturally and normally shed its leaves.

Thus the fall of the leaf is only a process of life. In a climate like ours, leaves must do one of two things—they must either fall when the cold weather and short days come, or they must cover themselves with a surface that will resist the cold and help the leaf to sleep—or dose—through the months of diminished daylight. Our evergreens have adopted the latter expedient : their leaves are very leathery, and, in the cases of high trees exposed to wintry storms, they are narrow and thread-like, and thus permit the cold blasts to sweep harmlessly among them.—
(*Timber Trades Journal*.)

English Forestry.

Referring to the appointment of Mr. Stafford Howard to the vacant Commissionership of Woods and Forests, the London *Daily Chronicle* regrets that a practical forester was not selected. Our contemporary continues :—" Had such an appointment been made, a gigantic field of usefulness would have been opened out. As things stand, we are virtually the one country in Europe in which the State cares nothing whatever for its forests—that great treasure of the common people—and neither knows nor teaches even the elements of the science of afforestation. Our national wealth of timber is under no skilled guardianship whatsoever. No steps are taken either adequately to preserve or to increase it. In Germany, more than half the forest area is under the direct or the indirect control of the State, and the stock of timber is subject to constant supervision and renewal. Here nothing is done. We have a small and poorly endowed school for the training of candidates for the Indian Forest Service at the Engineering College at Coopers Hill, within a stone's throw of the magnificent but grossly neglected woods of Windsor. But our own woodland area is suffered to go to wreck. At the same time we annually import some 6,000,000 loads of timber, and as many of the sources of supply are contracting, we may, within an ascertainable period, be face to face with a timber famine. In other words, we are—or were a few years ago—

spending some £13,000,000 sterling per annum on timber and timber products, while we have, according to the calculation of Mr. Schlich, the principal professor of Forestry at Coopers Hill, some 6,000,000 acres of waste land, which could, and should, be laid down as forests. Mr. Schlich estimates that we might annually plant some 300,000 acres employing at least 15,000 labourers which would sustain a population of 75,000 souls. After forests had been created, and (say in some forty years) we had entered on our new possessions, we should be, says Mr. Schlich, in a position to employ regularly some 100,000 workers, or a population of half a million people. It so happens that the opportunity for a national experiment in afforestation occurs at the very doors of the great Inferno of English poverty—the East End. There is plenty of waste land available between Barking and Pitsea, and Essex, especially that part of it which borders on London, is famous for its growth of English trees.—(*Timber Trades Journal*.)

Canadian Timber.

The *Montreal Daily Star* gives some figures to show the extraordinary advance in timber values, consequent upon the rapid felling of the pine forests. To an inexperienced eye there may be hardly an evidence at first glance of the disappearance of the pine. The hardwoods with which the pine is interspersed are usually left standing to a considerable extent, and so are the smaller pines, so that even a well-cut country will still look splendidly wooded. No doubt the time will come when it will be carefully re-cropped. But the commercial value is largely gone, and with it the natural desirability, for the cutting of the pine greatly lessens the value of the woods as vast reservoirs, holding the snows in spring and the rains of summer so as to feed steadily the innumerable streams of the water-sheds. Consequently spring floods and summer droughts for the cleared lands in the valleys follow close on the lumberman's axe. A certain amount of attention has been aroused by the rapid retirement of the pine. The Ontario Government has recently attempted to enforce strict precautions against fire, and it has also appropriated, as a provincial park, an enormous reserve near Lake Nipissing, thirteen hundred square miles, of which nine hundred are pine timber, situated on one of the chief natural watersheds of the province. But a great deal more than this is necessary if the Canadian pine forests are not soon to disappear like the tracts of Maine and New York. Enlightened men here are urging the establishment of regular systems of arboriculture, such as prevail in several of the chief countries of Europe, notably in France. It is hoped also that the Quebec Government will follow the lead of the Ontario Government in establishing a natural park on some of the main watersheds.—(*Timber Trades Journal*.)

An Arboretum in Australia.

Professor Brown, of the Dookie Agricultural College, Victoria, who is well known in Scotland, and the northern parts more particularly, has successfully established an arboretum in connection with that Institution, of which he has for several years been the Principal. The *Australasian* of August 19th contains a description of the arboretum and the progress which has already been made in the cultivation of trees and shrubs suitable for the climate of that colony. Two years ago, Professor Brown obtained the sanction of the Council of Agricultural Education to establish an arboretum to contain the principal native and foreign economic timber trees for the purpose of general reference, experimentation, and special education with his lectures. The first duty was to determine upon a list of trees which would have a fair chance of success under the particular conditions, for, while experimentation was a valuable element in the idea, there was, of course, no necessity for expenditure upon what experience and other knowledge of certain species said must be useless. Accordingly, Mr. Brown made out such a list, and submitted them to Baron Von Mueller, as well as to Mr. J. Ednie Brown, Director-General of Forests, New South Wales; Mr. G. Perrin, Conservator of Forests, Victoria; and Mr. D. Martin, Secretary for Agriculture. Each gave his opinion, and it is interesting to note that out of the 268 distinct species recommended, they objected to only half a dozen, and advised the additions of fifteen others. Professor Brown then selected seven acres of ground immediately south of the college building, having an eastern aspect, good virgin soil of medium texture, and abundant natural drainage. This was sub-soiled, thoroughly tilled, and fenced from rabbits. The whole space is kept free from weeds, and every attention given to each specimen, but no artificial watering whatever has been allowed. Planting is done at 25 ft. apart each way, and progress already made is such as to warrant the expectation that, in the course of a very few years, a very good arboretum will have been established in Victoria. The Council and the Secretary for Agriculture are giving Professor Brown every reasonable encouragement in the realisation of his project.—*North British Agriculturist*.

Patent Wood Fibre.

Mr. James P. Pile, builder and contractor, of the Brunswick Saw-mills and Joinery Works, 83, Great Brunswick Street, Dublin, has brought out a new "Patent Wood Fibre" which is well destined to become a useful article of Irish manufacture.

This wood fibre is, we are informed, being extensively used for bedding in many of the union workhouses and other large institutions in Ireland, and is strongly recommended as being more

comfortable, cleanly, and healthy than straw. It has the further advantages of being lighter and lasting longer, while the odour of the pine renders it an essentially sanitary bed likely to be of value in hospitals and infirmaries. It is also valuable for dog bedding, the well known quantities of pinewood shavings being present in a far more efficient form.

The maker points to its efficiency for packing purposes, mineral water manufacturers and export bottlers, finding it more suited to their needs than any other material. A special fine fibre, made of pure white wood, is prepared for silversmiths, biscuit manufacturers, confectioners, &c., and another form of the pitch pine fibre has been highly approved of by many important hospitals for its antiseptic qualities.

With this addition to his building and contracting business, as well as the conduct of his saw-mills and joinery works, Mr. James P. Pile should find his trade develop to a large extent during the coming winter. There should be a large market for his patent woodfibre which can be delivered at comparatively little cost in most Irish towns and villages. (*Timber Trades Journal*).

Pice Packets of Quinine.

A few months ago we published a short account of the new arrangements by which quinine is sold at Post Offices in Bengal, the Central Provinces and elsewhere, in small packets at 1 pice each. Our readers may be interested in the following figures shewing the value of sales during 1893.

	Rs.		Re.
January	... 189	July	... 1,305
February	... 177	August	... 3,399
March	... 207	September	... 1,990½
April	... 330	October	... 3,045½
May	... 523	November	... 4,262
June	... 872	December	... 3,402
		TOTAL Rs.	... 19,702

The number of packets actually sold was 1,446,900 which is not bad for the first year, and shews that the new scheme has 'caught on' and bids fair to be a great success.

The Hill Forests of Java.

(A translation from the *Först und Jagd Zeitung*.)

II

THE FORESTS BETWEEN 5,000 AND 8,000 FEET ELEVATION.

a. THE CLOUD ZONE OF WEST JAVA.

The forests of the moist zone are very similar both in East and West Java. If a difference exists, it is that in East Java, the number of species is not so great and the species that are represented are not those which are so dependent on excessive rainfall. But in the forest zone now under consideration the difference is very marked. In East Java this zone is covered with open forests of *Casuarina Junghuhniana*, whilst in West Java dense mixed forests cover the slopes. The principal differences between the moist forests and those in the zone immediately above them are as follows :—

1. The temperature at an elevation of 2,000 metres, (taking the average temperature at sea level to be 27.5° C. and allowing 0.56° C. for each rise of 100 metres) would average 16.3° C. and this is just at the elevation where the characteristics of the present zone are most marked. Variations in the average temperature are, at least in West Java, of not sufficient importance to seriously affect vegetation.

2. The intensity of direct sunlight and sun's heat should have some effect, but no exact *data* are available. As the forests are covered in this region nearly all day long by clouds, the sunlight can not have the same effect as, for example, on Alpine peaks, where this factor compensates for the low temperature of the air. It must, however, cause increased transpiration and evaporation.

3. Atmospheric pressure at 2,000 metres is, of course, much less than in the lower forests.

4. With regard to rain and cloud, the zone can aptly be called the "cloud zone," for, especially in the well wooded areas, heavy rolling clouds begin to form as early as 9 a. m. covering

everything in their folds till 3 p. m., when, breaking up in, sometimes, a dozen simultaneous thunder storms, they disperse and allow the evening sun to shine on the flowery canopy of the forests. If these thunderstorms do not take place, the forests remain wrapped in mist, so dense and damp that one cannot see 25 yards ahead whilst the Hygrometer stands at saturation point.

5. In spite of the continuous clouds, the actual rainfall in this zone is much less than in that immediately below it, for the saturated air sinks and deposits rain in the lower forests.

6. The relative moisture of the air is very high and sometimes reaches saturation point; but falls considerably during sunshine. In the same day the relative moisture may vary from 49° at 6 a. m. to 100° at 6 p. m.

Put concisely, the climatic characteristics of the cloud zone are as follows:—The temperature is not favorable to tropical vegetation, and tropical growth is replaced by sub-tropical and temperate vegetation. But most remarkable is the excessive humidity of the air in connection with the comparatively small rainfall; the presence in the air of a fine spray which covers all vegetation and also the soil with moisture without penetrating deeply; the occasional fine weather accompanied with a dry atmosphere, which, combined with the low atmospheric pressure and intense sun's power causes rapid transpiration and evaporation. These characteristics of climate are impressed upon the forest growth in this zone.

In East Java, the formation of cloud generally ceases during the dry season, but continues as in West Java during the wet season; a circumstance which is responsible for some differences in the conditions of vegetation in the two localities.

We can now proceed to consider the forests which exist in the cloud zone of Java. The characteristics of these forests point to the existence of a lower temperature than in those of the zone first described, although, of course, there must be an intermediate region, where tropical passes into temperate vegetation. There are fewer species present and these species are those which are formed in sub-tropical and temperate forests, they consist chiefly of *Amentacea*, *Lauracea* and *Podocarps*, the first are chiefly oaks but there are also various kinds of *Castanea*, *Engelhardtia* and *Lithocarpus Javensis*. Amongst the second are *Tetranthera*, *Polyadenia*, *Phœbe*, *Machilus*, *Persea*, *Daphnidium*, *Litsæa* and *Cinnamomum*. The most remarkable individuals in the forest are the varieties of *Podocarpus*, of which one—*P. cupressina*—has coniferous leaves, whilst the others such as *P. latifolia*, *Junghuhniana*, *amara*, and *bracteata*—have broad leaves. The occurrence of two palms (*Caryota propinqua* and *rufuracea*) in this zone is remarkable; they attain a height of 60-70 feet but are not frequent. The following smaller trees are common and strike the observer at once on account of the beauty of their inflorescence, viz., the various kinds of *Saurauja*; and, amongst shrubs, *Rubus*, *Melastoma* and *Ardisia*. Further, *Ericaceæ*, which are in the lower zone epiphytic, here

appear sometimes as independent trees, such as *Diplocosia diversifolia*, *Rhododendron*, (the former always epiphytic, the latter sometimes so in this zone) and *Vaccinium* and *Cyrtandra*. Amongst shrubs, the various kinds of *Strobilanthes* are most common: these throw up shoots 10 feet high and cover the surface of the soil often over large areas. In the upper part of this zone there also exists an immense *Lycopodium*, up to the present, unfortunately, unclassified; which, without being provided with special facilities for climbing, forms peculiar clumps or thickets on trees and bushes.

Bushy shoots of *Begonia robusta* are frequent in the upper portion of this zone, and specimens of *Astilbe speciosa*, not unlike the European *Spiraea Aruncus*, are also met with. As in the moist zone, varieties of *Impatiens* are common, but in the cloud zone the inflorescence is pale rose instead of deep carmine, and this is also observable in the flowers of *Strobilanthes*. In point of fact, in this zone, the flowers are generally small, or even almost invisible, and when large, are almost invariably white, exception to this rule occurs with epiphytes. In the moist zone, on the other hand, there is much richness and variety in the colouring of the flowers. Amongst herbs one may observe many *Rubiaceæ* (*Ophiorrhiza*), *Cruciferae* (*Pteroneuron javanense*) all with white blossoms; besides individuals of *Sanicula*, *Elatostemma*, *Pilea*, etc..

The ground in the upper part of this zone above the thickets of *Strobilanthes* is generally covered with moss and ferns and often with *Rubiaceæ* and *Nertera depressa* which is cultivated in pots in Europe on account of its peculiar creeping habit and its fine red berries. The characteristics of tree growth are not similar in the moist and cloud zones; the trees not so large in the latter, and buttressed trunks have almost disappeared, the leaves are smaller; the proportion of wood and leaf has altered in favor of the former, in fact the habits of the trees do not vary much from those of broad leaved European species. At the same time, the absence of large climbers is remarkable; whilst of epiphytes, those requiring a heavy rainfall no longer exist, especially those which take root in the ground and ultimately become trees; the woody epiphytes which still find place in this zone are mostly small and often provided with water reservoirs. Thus, the taller vegetation in this zone shows the effects of a pronounced decrease in the deposited moisture, whilst the lower vegetation remains, as in the moist zone, a growth with tender leaves and superficial roots which can exist without a heavy rainfall, provided the air is laden with moisture. The most typical examples of such vegetation are those epiphytes which grow from a surface net-work of roots; and the entirely rootless *Tillandsia usneoides*.

The branches of the trees are here veritable atmospheric gardens which produce, in the lower portion of the zone, ferns,

orchids and even bushy *Ericaceae*, but in the upper portion only mosses. The cloud zone of the Java forests might indeed be divided into two regions according to the epiphytic growth. In the upper, the luxuriance of mosses more particularly characterizes the forests.

Strobilanthes, scarcely 5 feet high, can be observed festooned with moss, even the leaves covered with a fine growth of the same; whilst from the trees over head hang flags of moss 2 feet long, so close together that it becomes impossible to see beyond a few yards, and the trunks of the trees are covered with thick layers of the same growth, which even in fine weather, stream with moisture. On these mossy coverings, epiphytes are constantly present, but only those which exist on the surface; such as *Orchids*, *Peperomia*, a few *Vaccinieae* with their globular water cisterns, *Hymenophylla*, and other large and small ferns. But these epiphytes as compared with the luxuriance of mosses, do not specially characterize the forests of this upper region, for their true home is in the forest at a lower elevation, where the immense *Asplenium Nidus* can be seen by hundreds, and where varieties of *Lycopodium* hang from the branches in streamers of over 6 feet long. As we ascend, the water-loving species are more and more uncommon, and we reach, finally, the Alpine regions where the vegetation is quite different.

b. THE CLOUD ZONE OF EAST JAVA.

The climate of East Java is much dryer than in the West, and the vegetation in the cloud zone in the East presents a much more marked type than in the same zone in the West of the island. Rain and cloud are there not sufficient to overcome the drying effect of low pressure and insolation, and in consequence the number of species decreases and also the density of the forest. The most important tree is *Casuarina Junghuhniana*, the only tree which reaches a large size in this region, and illustrates by its scanty foliage and massive bole the effect of a dry atmosphere. Other trees, such as *Quercus pruinosa*, *Albizia montana*, *Dodonaea viscosa* are either very small or often mere shrubs. Looking up at the five pointed pyramid which rises abruptly from a plateau of 1,500 feet elevation to a height of 10,350 feet, the existence of well defined zones is at once evident. The base of the pyramid is covered either with coffee gardens or with grassy fields; then follows a belt of forest extending from 5,600 to about 9,000 feet, which shows a series of peculiar transverse markings due to the variation in species consequent on the nature of the soil, for this holds more or less moisture according to whether it lies on the ribs or gullies which seam, with great regularity, the sides of the volcano.

The former appear black and are covered with *Casuarina*; the latter brown and support a growth of *Quercus pruinosa*. The

forest belt is sharply defined both above and below. The summit of the pyramid appears of a yellow green color covered with an alpine treeless turf from which bare peaks or smoking masses of rock appear, whilst the dead craters are covered with forest growth up to their summits.

The grassy plains, at an elevation of some 4,500 feet, are due to interference, by nature or man, with the forests of the moist zone, and are not of any special interest. They are covered with various grasses and with scattered bushes of *Melastoma*, an *Albizia* and *Parasponia parviflora*. Similar grasses and shrubs grow in the *Casuarina* forests in the lower part of this zone; whilst in the gullies various broad leaved trees are found, besides the oak already mentioned, this latter grows up to an elevation where tree vegetation finally ceases.

In the lower part of this cloud zone a few tree ferns are still found, as well as *Dodonaea montana* and *Lespedeza cytisoides* which, however, finally disappear at a still greater elevation; but the branches of the scattered *Casuarinas* are covered with thick leaved Orchids, a few small leathery ferns and lichens.

With increasing altitude the character of the *Casuarina* forests alters considerably, the trees become more numerous and higher, but yet do not form a dense forest, lichens increase in number, and a small fleshy orchid with orange and carmine flowers is noticeable. The heavy growth of grass which springs up in the lower forest no longer exists, the ground is covered with the needle-like leaves and the twigs of *Casuarina*; the vegetation peculiar to the moist zone has ceased to exist and the whole character of the forest growth approaches that of European coniferous forests. The small leaved odorous *Festuca nubigena* and *Euphorbia Rothii* (which is similar to *E. amygdaloides* of Europe) are common, bunches of dog violets, *Plantago asiatica*, white pimpernels, small *Gnaphalia* and *Pteris aquilina*, all recall European forests to us.

On the gentler slopes, vegetation becomes more vigorous and there are many bushes to be found, such as varieties of *Antennaria* (*A. saxatilis*) which sometimes attain the height of a man and the dignity of a small tree. Amongst shrubs, *Sonchus javanicus* recalls *S. arvensis* of Europe, *Valeriana javanica* reminds one of *V. officinalis* and many others are found which irresistibly carry one's thoughts back to the coniferous forests of Europe. The whole vegetation of this region points to a small rainfall with great moisture in the air; though this moisture is not nearly so great as in the corresponding zone in West Java; a fact which is fully proved by the absence here of the luxuriant growth of moss and the limited size and number of epiphytes.

(To be continued.)

Mixed Forests of Deodar and Blue Pine.

Enough has been said already on the bad effects attending the treatment of a pure Deodar Forest by heavy fellings in my note on Deodar in Kulu published in the *Indian Forester* for May 1893. I would try now to explain in the following pages what such fellings, if carried on in a mixed forest of deodar and pine, will result in.

Perhaps none of the conifers is so common in Kulu as is the *Pinus excelsa*—the five-needed pine of the Himalaya. It is not unfrequently found associated with the deodar and in some localities grows pure both above and below the Deodar forests. As an instance of a pure forest, may be mentioned the extensive forest of *Gathrang* above the deodar forest of Nachar in Bashahr, while *Kailidugh*, *Bakarkyara* and *Borsu* in Kulu proper, *Ramguruh*, *Shikarwa* and a good many other forests in Sahraj and *Shalanda* forest in Waziri Rupi may be mentioned as representing the forest below the deodar. It is with the latter kind of pure forests I propose chiefly to deal.

All such forests are comparatively young and are generally found in the proximity of large villages and towns. It is certain that all these forests once supplied the greater part of the timber required by the villagers and the townsmen for the construction and repair of their houses and shops. Consequently, every one of them was once clean or almost clean cut.

In all those above named and other similarly situated forests, the blue pine grows at present almost pure with a very little sprinkling of deodar here and there.

It cannot be doubted, however, for a moment, that these localities are a little too low for kail and are better suited for deodar. It is probable, therefore, that these forests were once almost pure deodar; but the heavy fellings have, in recent years, converted them into pine forests. The still existing terraces of the abandoned fields, now occupied by the pine, are a proof beyond doubt that a few occasional crops were taken off the areas thus cleared of the trees. A few saplings of the cedar and the pine which were too young to yield any good timber were left standing on such-terraces and in the fields. Such saplings served afterwards as seed bearers and are now distinctly visible, even from a distance, in all these forests.

Now, it is, I believe, a well known fact that *Pinus excelsa* bears seed at a very early age, and I have seen plants from ten to twelve years of age bearing cones. It seeds plentifully and almost every year. The seed is much lighter than that of the deodar and consequently is easily carried by the wind and scattered all over the place where, if the circumstances are favourable, it reproduces itself in great numbers. The young seedlings which thus spring up are remarkable for their very rapid

growth in their early age, so that wherever there is sufficient light and air they will readily develop a strong tap root capable of forcing its way into the soil where they thus fix themselves firmly before worthless species such as *Viburnum*, *Desmodium*, *Indigofera*, *Prinsepia*, *Berberis* and straggling shrubs such as roses and brambles have time to come up and occupy the areas denuded of trees by excessive fellings and consequently exposed to light and air, which conditions are, of course, equally favourable for the growth of these inferior species. Consequently wherever, in the above forests, the fields remained uncultivated for a few successive years and wherever the slopes denuded of trees had not yet been covered with worthless growth, numerous seedlings of kail sprang up. Thus the tree gradually moved on, and with it the cultivation till the whole of the area was taken up by kail.

But such a capability of springing up is not granted to deodar. It does not, moreover, bear seed before it has attained a considerable age, and the deodar saplings which escaped the ruthless hands of the villagers were too young to bear seeds. This explains at once why not a single deodar seedling came up anywhere along with those of the pine.

The occurrence of pure kail forests in the localities so well suited for the deodar may be attributed to such conditions as the above.

Now, from what has been said above, it will be understood that in a mixed forest of kail and deodar, worked for deodar, heavy fellings always favor the natural growth of kail. I am therefore of opinion that no mixed forest of deodar and pine should be heavily worked over.

In places where the young reproduction of deodar is very vigorous and the plants have firmly established themselves, every mature tree whether a deodar or a pine may be removed to give more light and air to the young seedlings. But if the young growth is scanty, the best method to work out such a forest is by improvement felling, otherwise we may convert an almost pure forest of deodar into an almost pure forest of pine.

It is true that a mixed forest of deodar and blue pine heavily worked over does not suffer to such an extent as a pure forest similarly treated does, for the reason that in a mixed forest so treated whatever is a loss to the former, is a gain to the latter, while a pure forest of deodar similarly treated may sometimes altogether disappear.

Now, the pine's gain is, later on, the Deodar's gain, as well. But the question of time has to be considered, as will be seen presently. The pine always requires space and a large amount of light. No pine seedling would ever stand shade, hence the young reproduction of pine in all these pure or almost pure and well stocked forests, is quite absent.

Deodar, on the other hand, stands shade remarkably well. This quality of deodar gives it a decided advantage over its companion. Now somehow or other the deodar is sure to get itself

introduced into these forests again. Each one of these pure forests of pine will gradually be converted into a mixed forest and finally it will become one of pure deodar. But, as I have said above, such a process requires time.

I must not, at the same time, omit to mention the evil consequences resulting from the exercise of certain concessions in these forests. The manure most valued in Kulu and on which the people so much depend for the fertilization of their fields, consists of the needles of blue pine, either green or dry. The custom of lopping green branches of this pine for litter and ultimately for manure prevails mostly in *Waziri Rupi* and *Sahraj*, although it is not quite unknown in Kulu proper. The dry leaves of the pine are also collected for this purpose during the month of April, just about the time when the pine sheds its needles. Now, as has been already said, most of the forests of this pine whether pure or mixed with deodar, lie close to the villages and are, of course, daily resorted to by the people during the spring for the dead leaves. But this is exactly the time when the deodar seed begins to germinate and if it has already germinated anywhere, the seedlings are yet too young to develop a strong tap root and have hardly yet thrown off their seed cap. Consequently every deodar seedling which comes up in such forests and more especially in the places where the needles form too thick a covering for their tender tap root to pierce through to reach the soil below, is taken away with the dry leaves. It is necessary, therefore, that in order to ensure the natural or artificial reproduction of deodar in such forests, that such an injurious privilege may be stopped at least for some time after felling operations have ceased.

Another principle, however, which we must not lose sight of while treating a mixed forest of deodar and pine, is to be careful in attempts to kill the latter and other small sized trees, such as re-stock even the most ruined areas very quickly, do not allow inferior species to spring up and make the regeneration of deodar easier and cheaper.

It is, of course, very easy now to grow deodar in all these low lying and well stocked pure forests of the blue pine, but had it been tried to get rid of every pine plant in order to make room to raise the cedar at the time they had been clean, or almost clean cut, such attempts would have probably resulted in the disappearance of both these species.

Thus the more I observe, the more deeply do I feel that in order to maintain a Deodar forest, the best method to treat it, whether it is a pure or a mixed forest, is by light fellings.

KULU,
15th June, 1893. }

MIAN MOTI SINGH.

The French Forest Department in Algeria.

An article entitled "A Lesson from Algeria" appeared some little time ago in the *Pioneer*. This article, which was taken from the *Revue des Eaux et Forêts* of the 25th February last and which contains a series of accusations against the Algerian Forest Department, is really an extract of a report drawn up by a Commission of which the late M. Jules Ferry was the president, appointed to examine into the question of the modifications required to be introduced into the legislation and organisation of the various services in Algeria. The writer concludes his article in the *Pioneer* after accepting the statements of general mismanagement, and attributing this state of affairs to the fact of Algeria being a sort of penal settlement and asylum of bad bargains, by endeavouring to draw a lesson from this for the benefit of our own Government, which he states allows one or more provinces in India to be recruited from the prizemen of Coopers Hill, and others to be regarded as receptacles for the inferior residuum, inasmuch as by a new and unnecessary rule every student has a choice of province in accordance with his place on the list. It is, as most Forest Officers will be aware of, no new rule that the writer refers to, but an old one which has just been abolished, old enough, indeed, we think, to justify us in supposing that the writer of the article referred to might have heard something of it, had the disastrous results he anticipates resulted from it.

Our object, however, in this article, is not so much to discuss the application and fitness of the "Lesson from Algeria," but to say a few words in defence of the Forest Department in Algeria which, in this case, as is perhaps not altogether unprecedented in other countries, seems to have been made to bear more than its own share of the public indignation, when things were found to be working less smoothly than they should do.

Had the writer of the above mentioned article perused the subsequent numbers of the *Revue des Eaux et Forêts* he would have seen that a great many of the statements made in the report contained in the February number have since been contradicted, and many of the charges brought against the Department explained. For instance, as regards the enormous fines complained of as having been extorted from the people for, in many cases, petty offences, the figure quoted in the above mentioned report as the amount of fines realized in 1890 is 1,658,958 fr. whereas the financial returns for that year show a sum of 210,582 fr. as the total realized under this head. There is a sufficient difference between the two figures to nullify the effects of any arguments based on the former.

As regards the question of revenue and expenditure, it would appear that, with the exception of the cork oak forests which cover about one ninth of the total area of the State forests in Algeria, the

greater part of the forest area is not yet capable of regular working. The climate is a hot and dry one, where strict conservation is all the more necessary, if deterioration is to be prevented, and although before the French conquest, these lands belonged to the State, according to the Mussalman law it is not astonishing that they should have suffered severely from over grazing, burning and injudicious working. The results of the protection afforded them in recent years under the management of the Forest Department, can be appreciated by comparing them with the forest lands belonging to the Communes and private estates adjoining them. A private owner could not reasonably be reproached for not deriving much pecuniary benefit from a forest, made over to him immediately after its exploitation. The utility of the State Forests in Algeria is not measurable, either, by the mere amount of revenue derived from them. Another of the results of the unreasoning and rigorous conservation complained of by the writer in the *Pioneer* is the exclusion of cattle from their accustomed pasturage. As to this, grazing, if excessive before, must necessarily have been restricted; but in one department only, that of Oran, I find a statement giving 416,540 as the number of cattle, sheep, &c, grazed in the State Forests during 1890.

There is, however, one source of revenue which does not appear to have been made the most of, and that is the cork oak forests. The realization of this revenue, however, requires a previous expenditure of a considerable sum on the operation of "démasclage," or the removal of the outer layers of so-called male cork. The delay in this matter does not appear to be entirely the fault of the Forest Department, as it was only on the repeated representations of the Department, supported by the Governor General and the Algerian deputation, that in 1885 the State allotted the necessary funds for this work. In a few years, from this source alone, the forests of Algeria should be able to cover the costs of management.

The want of exactitude in determining the respective rights of the State and the residents, complained of in the report quoted in the *Pioneer*, is a matter for which the Settlement Commission appointed for this work would appear to be more justly responsible than the Forest Department. Here, as perhaps might be found to be the case in some instances in India, boundaries seem to have been laid down without previous examination of the ground, with the result that important forest areas whose preservation should have been ensured, have been excluded from the limits of the State forests, while extensive areas of cultivated and other unsuitable land have been included in these limits. Subsequent efforts appear to have been made to reclaim some of these lands, thus improperly excluded, which have not unnaturally resulted in ill-feeling against the Department into whose charge they thus passed and it is not difficult to imagine that the inclusions above

referred to, have likewise led to mutual recriminations between the Forest Department and the people concerned, especially in those cases where the lands thus included had not been properly demarcated at the time ; these, in some instances, being actually occupied, and consequently the right of possession had to be respected in consideration for the people, in spite of the legal fiction declaring the land the property of the State.

The Forest Department complains of the inconsistency of its adversaries, that certain members of the "corps élus" discuss forest reforms most willingly but with a competence similar to that of a pleader discussing military manœuvres ; the Algerian Press takes up the cry, enlarges on the question, and excites or amuses the public until something else occurs to occupy its attention. Thus, in 1883, nothing would suffice but that the whole of Algeria should be reforested, to put an immediate stop to drought. In 1885 it became equally urgent to eradicate all the forest situated on the plains and lower hills, in order to encourage colonisation : and now, in 1892, a return to the ancient Arab *régime* is demanded, that the forests be turned into grazing grounds and other produce be made a secondary consideration. The prime cause of the present outcry appears, however, to lie in the resistance offered by the Forest Department to the lessees of Government Forest land acquiring proprietary right in the same. Under the old *régime*, when the forests were under the direct management of the Governor-General, considerable areas of cork oak forest were alienated, first by lease, then finally after several renewals in full proprietary right on conditions most disastrous to the State.

It is chiefly against these areas of cork-oak forest that the attacks of speculators, so called colonists and others, are directed ; in 1876 a further area of some 150,000 acres of this forest was leased out for a term of years with certain provisions regarding works to be carried out by the lessees. These provisions were not fulfilled, the farmers devoting their attention to obtaining under various pretexts, renewals of their lease, in the hope that from renewal to renewal they would at last arrive by virtue of their importunity in obtaining the same proprietary right as their predecessors had done. The resistance offered to these speculators is, it is believed, one of the chief causes of the present attacks on the French Forest Service in Algeria.

We are not, of course, in a position to say how far the French Forest Department is to be held blameless for the present state of affairs ; doubtless there is much to be said on both sides of the question, all we have endeavoured to do is to say a few words in its defence to set against the unqualified condemnations of it contained in the article under reference.

Note on experiments on Charcoal.

In view to furnish the Inspector General of Forests with a list of trees which are highly appreciated for charcoal burning, experiments were made in some Ranges of the South Arcot District on the charcoal yielding capacity of woods of indigenous trees. Only such woods as are generally used and appreciated by natives for charcoal making were selected. The result of the experiments will be found below.

Mode of conversion: The method adopted for converting wood into charcoal was the one generally followed by natives and it need hardly be said that it is, perhaps, the crudest and most primitive method known. The wood intended to be used is cut up into billets of convenient size and heaped up in a pit whose dimensions vary with the quantity of wood to be burnt. In the case of *thin* wood such as Kassau (*Memecylon edule*) the whole quantity, which does not exceed generally a cartload at a time, is packed in the pit and then fire is applied on all sides to the bottom layer of wood. When fire has made sufficient progress, a thick layer of green twigs and leaves is thrown over the burning mass and over it again a layer of sand or loose earth to shut out air. In the case of *thick* wood about a fourth or third of the whole quantity is first thrown into the pit and uniformly spread over the bottom. Then fire is applied and kindled with straw, dead twigs and other easily ignited stuff, and as soon as the wood catches fire and begins to burn well, the remaining quantity is thrown in and the pit allowed to remain open for 4 or 5 hours until the fire has progressed sufficiently well to ensure the burning of the whole. Then it is covered over with green twigs, leaves and earth as above noted. From time to time a pointed stick is run through the covering to ascertain whether carbonization of the wood is going on satisfactorily. If smoke and vapour come out in large quantities from the surface of the covering or through the openings made by the stick, more earth is thrown over to shut out the air. If, on the other hand, no smoke and vapour escapes through the holes or if the quantity thus escaping is so slight as to indicate that fire is going out, more air is let in by making as many openings in the covering layers as necessary. Thin wood is found to require about 40 to 50 hours to carbonize. Thick wood takes a much longer time, varying from 3 to 6 days, according to the size of the billets used; after the whole is quite cool, the pit is opened and the charcoal taken out. Four tons of wood were converted into charcoal in my Range, and in every case it was found that a large proportion of the wood, varying from $\frac{1}{6}$ to $\frac{1}{4}$ of the total quantity put into the pit, was left unburnt, of course the unburnt wood was again thrown into the pit and carbonized.

STATEMENT No I.
Detailed results of experiments.

Forest Range.	Species of wood used.	Quantity of wood used.		Quantity of yield of charcoal.		Yield of charcoal per ton of wood.		Percentage of yield.		Cost of the whole operation calculated per ton of wood burnt.			Remarks.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs.	A.	P.	
Tindivanam ...	Kassau ...	2240	498	498	22.24	2	0	0					(1)
Virdachallam ...	do. ...	336	64	426½	19.01	3	5	4					
	Average ...	...	...	462½	20.62	2	10	8				
Tindivanam ...	Karungali (Acacia sundra) ...	2240	537	537	23.98	2	0	0					(2)
Kallakurchi ...	do. ...	2240	373	373	16.64	not	given						
		...	...	455	20.31	...	...	...		
Tindivanam ...	Tamarind (Tamarindus indica) ...	2240	470	470	21.00	2	5	6					(3)
Tindivanam ...	Turinji (Albizzia amara) ...	2240	510	510	22.77	2	5	6					
						
Virdachallam ...	do. ...	420	66	352	15.21	3	5	4					(4)
Tirukoilur ...	do. ...	2240	466	466	20.80	not	given						
Kallakurchi ...	do. ...	2240	361	361	16.11	do.	do.	do.					
		421½	18.72	2	13	5					(5)
Virdachallam ...	Karuvelam (Acacia arabica) ...	2240	387	387	17.27	3	2	0					
Kallakurchi ...	do. ...	2240	339	339	15.13	not	given						
		363	16.20					(6)
Tirukoilur ...	Velvelam (Acacia leucophloea) ...	2240	392	392	17.50	not	given						
						

Statement No. II.

Comparative average outturn of charcoal per ton of wood different kinds given in the order of highest yield.

Species of wood.	Yield of charcoal per ton of wood.	Percentage of yield.	Cost of the whole operation calculated per ton of wood burnt.			Remarks.
			Rs.	A.	P.	
Tamarind ...	470	21.00	2	5	6	
Kassau ...	462½	20.62	2	10	8	
Karungali ...	455	20.31	2	0	0	
Turinji ...	421½	18.72	2	13	5	
Velvelam ...	392	17.50	not	given		
Karuvelam ...	363	16.20	3	2	0	

A comparison of the results of the experiments made in different Ranges on one and the same kind of wood show great variation in the yield of charcoal, as will be seen in statement No. 1. I am inclined to believe that this is due to mistakes made in weighing the wood and charcoal, or to omission to return unburnt remains of wood. Whatever cause it may be due to, this result cannot be taken to represent the standard yield of charcoal by the different woods dealt with; but it may be assumed that it gives a fairly approximate idea of the charcoal yielding capacity of each species when carbonized in the local primitive fashion.

From what statement No. II shows, it may be roughly stated, making ample allowance for mistakes made in conducting the experiments, that each of the woods dealt with yields about one fifth of its weight of charcoal when manufactured in the local native method. Judging from the above one fifth results and the value of green Kiln wood in this District, it may be safely observed that charcoal burning is financially a loss here.

Charcoal making in European fashion would doubtless yield much better and more satisfactory results, and it would be really worth while and interesting to experiment on a larger and more extensive scale.

It would be interesting and instructive to study the results of experiments made in different parts of India on the subject both on the European and Native methods. I learn that charcoal is manufactured on a pretty large scale in North Arcot District in the European fashion; if so, I hope an account of it will be published in the *Indian Forester* by some one who has a personal knowledge of it.

M. R.

GINGEE,

3rd February, 1894,

Tasar Silk production in the Central Provinces.

The production of tasar silk in the Central Provinces will, it is hoped, be substantially promoted by the following order issued in 1892 by the Chief Commissioner. The representations which led to the issue of these orders were supported by the result of detailed enquiries showing that the pollarding of saj (*Terminalia tomentosa*) trees required for tasar cultivation could be worked, and indeed was worked, on a proper rotation, and that the growth of the worms could be carried on year after year on limited plots or *baris*, without causing any destruction to the forests at large.

RESOLUTION.

The Commissioner of Settlements and Agriculture has represented that the production of tasar silk in these Provinces is declining, notwithstanding the issue of orders by this Administration for its encouragement in accordance with the desire of the Government of India that the production of silks indigenous to India might be promoted. The principal reason assigned by the Commissioner of Settlements and Agriculture for the decay of the industry is that the cultivation of tasar worms has been discouraged in Government Forests; and Mr. Fuller invites attention to the fact that the orders issued in Book Circular No. VI of 1883, which while prohibiting the pollarding of saj trees in Government forests where they were grown for timber, authorised the selection of tasar silk rearing grounds in tracts from which no useful timber could be expected, have had the effect of stopping the growth of tasar altogether within forest limits. It is stated that inasmuch as the industry brought in no income to Government, it has been regarded as injurious to forest interests, while the policy of the Forest Department has influenced the action of Government Officers in Court of Wards Estates, and has also had some effect on *malguzars*, who have latterly given fewer facilities to the tasar rearers than they used to do.

2. The proposals which Mr. Fuller makes with a view to improving the tasar industry may be stated as follows :—

- (1) that in second class forests the leasing out of suitable areas to *Dhimars* for tasar cultivation should be accepted as one of the regular incidents of forest management ;
- (2) that the areas within which tasar cultivation should be permitted should be determined by the Forest Department in communication with the Agricultural Department, and it should be made known to the people that cases for tasar *baris* or farms will be given within these areas ;
- (3) that the levy of a small acreage rate of one or two annas an acre might be prescribed ;

- (4) that a similar policy should be followed in Court of Wards Estates, which contain forests suitable for tasar cultivation, in localities where tasar is produced.

3. The Commissioners of Divisions and the Conservators of Forests, who have been consulted on these various points are generally of opinion that the rearing of the tasar silk-worm has greatly declined of late years, and that it has entirely ceased in Government forests. They consider that the industry will thrive if facilities are afforded to the people in Government forests, and concur in the suggestion to allot suitable areas for the purpose.

The measures which are proposed commend themselves to the Chief Commissioner as reasonable, and he desires that the selection of suitable areas may be taken up without delay by the Forest Boundary Committee, consisting of each Conservator within his own circle and the Commissioner of Settlements and Agriculture as representing the Agricultural Department.

4. The decision as to the districts in which such action is both feasible and desirable must apparently depend upon climatic considerations, and the existence of a sufficient number of Dhimars, who are, with few exceptions, the only people that practise the industry. The districts which may be regarded as the home of the tasar worm are situated in the southern and eastern parts of these provinces, viz., Chanda, Bilaspur, Sambalpur and in a minor degree Balaghat, Seoni and Bhandara. Apparently there are plenty of Government forests in Chanda which could be utilized for the purpose, and in Sambalpur, though the area of Government forest is small, some 5,000 acres could, it is reported, be set apart for the purpose, while certain areas are also available in Bilaspur, Bhandara, Chhindwara, Seoni, and Balaghat. In the last-named district, the Conservator, Southern Circle, apprehends that the available areas may prove too damp and cold, but this is a matter which practical experience can alone determine.

In the Northern Circle, the industry is reported to be practically unimportant, and frost, hail and cold, are said to militate against the propagation of the tasar of commerce which is the product of the cold weather crop. The Conservator reports that, if Dhimars can be found to undertake cultivation in Mandla, Betul, Hoshangabad and Nimar, a sufficient area of saj forest might be made available. It may be doubted whether the Dhimars will undertake the experiment; still the Chief Commissioner considers it desirable that suitable areas of saj forest in these districts should likewise be assigned for the purpose, so that, at all events, the Administration may be freed from the reproach of destroying the industry by its forest system.

In the remaining districts, little or no cultivation appears to have been carried on at any time, and as the Dhimars are very few, no action in this direction seems called for.

5. The most convenient area for the *baris* would, in the Chief Commissioner's opinion, be about 20 acres, and this should be divided into four compartments of 5 acres each, only one of which will be under *tasar* in any one year. The Chief Commissioner considers that it would be advisable to charge a rent for these *baris*, as proposed by the Commissioner of Settlements and Agriculture. As at present advised, he would fix the rate at four annas per acre per annum for the land actually under crop, nothing being charged for the fallow land. Or, if the people preferred it and it suited better, one anna per acre per annum might be charged for the whole *baris* of 20 acres, fallow included.

6. Apart from the action to be taken in Government forests, as indicated in paragraphs 3 and 4, the Chief Commissioner desires that early steps should be taken in the same direction in those Court of Wards Estates where there is any hope of success, *e. g.*, Phuljar and Borasambar of the Sambalpur District.

The selection of the sites for *baris* in these estates will rest with Deputy Commissioners, acting under the control and guidance of the Commissioner of the Division.

7. In conclusion, the attention of the Forest Department is invited to the proposal made by Khan Sahib Mahomed Ghouse, Forest Divisional Officer, Balaghat, that *tasar baris* should be given free of charge to Dhimars who agree to settle in Forest villages and to work for the Forest Department at the usual rate of wages during the time their services are not required in connection with *tasar* cultivation. This plan, if feasible, might solve, in certain localities the problem of obtaining local labour which so often gives trouble to Forest Officers, and impedes work.

—*Agricultural Ledger Series.*

Agriculture in Cuttack.

We have received a copy of an important and valuable Report by Mr. N. N. Banerjee on the agriculture of the District of Cuttack in Orissa, which must have almost exhausted the subject of the condition of the delta District of the Mahanadi.

We have examined it with great interest, and congratulate Mr Banerjei on having done such a useful and complete piece of work. Our readers will hardly care to hear much of it, however, except from the special point of view of the Forest Department. So far, there are no reserved forests in Cuttack and we are not quite sure that there are any waste lands, the property of Government, that could be reserved. But there are considerable areas of forest here and there and notably there are the delta forests on the coast, the property, we believe, chiefly, of the Maharajah of Burdwan. There must also be a good deal of forest in the Sukinda estate; and in his discussion of the question of 'Fuel supply' at page 121, the author says that that supply comes from "the jungles 'of Dompura, Harispur, Kanika, Kujang, Sukinda, Madhupur, 'Patia and other petty forest tracts" which aggregate about 513½ square miles. Mr. Banerjei quotes the price of firewood in 1873 at 200 seers per rupee, while in 1890-91 it was only 80 seers; but all the same, he does not think that it is so much the fuel that is scarce, but that the difficulties of obtaining it have increased, chiefly through the tendency to increase cultivation at the expense of the jungles. He also remarks on the scarcity of fodder, and his suggestions for improvement, which we give *in extenso* herewith, will be read with interest, especially as they seem to us to agree with the recommendations of Dr. Voelcker.

*"Suggestions for improvement.—*In the way of improving 'the fodder-supply, I may here urge the necessity of reserving 'grazing grounds. During the settlement now in progress, large 'tracts may be set aside for fodder and pasture reserves, so that 'the evil which has converted grazing into arable land may not 'continue as it must inevitably do otherwise. It should now be 'seen that no undue proportion of waste land be brought under 'cultivation. The Government may acquire such uncultivated 'lands and reserve them, and gradually convert thorny brushwood 'or bare rock and stone into tracts covered with vegetation edible 'by cattle. Under systematic artificial care and treatment there 'seems no reason why the ultimate financial results should not 'more than cover the initial expenses that would have to be incurred in acquiring and protecting the lands. There is a tendency 'among zimindars, natural under the economic conditions that hold 'at present, to have all their waste lands brought under cultivation. 'They offer favourable terms to induce ryots to break up the 'jungle and bring jungle land under the plough. Laudable as 'such efforts are on the part of the zimindar, in the face of the 'fodder scarcity which is making itself felt more day by day, it 'seems desirable that they should rather turn their energies to 'improving these forest lands by cutting down useless brushwood 'and planting in their place useful trees, such as the sissu or teak, 'which, in the course of ten or fifteen years, would supply wood

‘which would not only serve as valuable fuel, but be available also for building purposes, or, what comes more under this chapter, by doing away with the jungles altogether, no doubt at some expense to themselves, and converting them into extensive pasture grounds.’

With these recommendations, generally, we also agree, but we cannot help protesting, as we protested when we read Dr. Voelcker's Report, against the fallacy of imagining that the same area will produce both *pasture* and *improved forest growth*. The holder of a deposit account at a bank might just as easily expect to be able both to gradually withdraw his deposits and to obtain a permanent fixed income from the original capital. No one who knows the conditions of forest grazing in this country, will be so bold as to think that in a District where pasture is admittedly scarce, forest tracts can be improved or created, while at the same time they are over-run by cattle. By all means, let the Government acquire forest and waste lands ; in our opinion they ought to do so even in permanently settled Districts and still more so in Districts like Cuttack, which are liable to famine. But having done so, it will be better policy to make a sharp division and separate off and close to pasture those areas which are to produce supplies of wood and timber, while managing as pasture grounds such others as may be available, without expecting to see them produce a wood supply as well. No one who has ever seen the waste lands in Puri, the District adjoining Cuttack, can possibly imagine that any thing short of complete protection against cattle, and especially goats, can restore them to a condition of capability of supplying even small fuel, much less timber of any kind. However, it is something to find that Mr. Banerjee goes as far as he does ; for twenty years ago a native official who held such views as he has put forward, would indeed have been a rarity. We are not very sanguine that Government will accept his suggestions and carry out the proposal of acquiring waste lands to be managed partly as permanent pasture grounds, partly as closed forests for the supply of fodder grass and fuel, but it is the right thing to do, and Bengal is probably the Government which is most likely to start the work, if any do. The notion about planting looks well on paper, but it is not so easy in practice : for there are few things so difficult in India as to rear plantations on poor over-grazed land.

Chapter IX of the Report gives a list of 40 timber trees which will be useful locally, but we should hardly have called the wood of *Terminalia Belerica* white, that of *Alseodaphne Melanoxydon* dark red, or that of *Kydia calycina* brownish. There are also lists of food plants, fruit trees, dye plants, trees yielding oils and gums and fibres and a long and exhaustive catalogue of medicinal plants. In the final suggestions, the planting of date and areca nut palms is strongly recommended.

Wood Paving.

The subject of wood paving for the streets of our large towns referred to in Volume XIV page 780, of the *Gardeners' Chronicle*, has occupied so much attention of late that a few additional remarks on the subject may be useful. So long ago as 1889, the question of the superiority of Jarrah (*Eucalyptus marginata*, not *rostrata*) over Karri (*E. diversicolor*) was contested by those who were interested in the woods being adopted by the vestries of Islington, Chelsea, and Lambeth, and by the District Board of St. Martins-in-the-Fields. The correspondence on this matter was published in the Kew Bulletin for September, 1890. Since that

time, the vestry of St. Pancras has used Jarrah wood to some extent, and it has been adopted by other public bodies, notwithstanding its very high price in the first instance, as the wood arrives in this country already cut into the blocks fit for use. It is very necessary that these blocks should be cut from well seasoned and sound timber, for if they twist or warp on the voyage, they lose much of their value for a purpose where it is required that they should form a close and compact body when laid.

So recently as the 13th of last month (December) a paper was read before the Society of Arts by Mr. Lewis H. Isaacs, surveyor to the Board of Works for the Holborn District, on "Carriageway Pavements for large Cities," in which the subject of wood pavement was treated of. Referring to the work of one large company interested in promoting the application of wood for paving purposes, it is stated that the Company in question laid during the period from 1872 to 1889, 1,030,000 square yards, equal to an average of 58,000 square yards per annum, and from 1890 to 1893, 520,000 square yards or an average of 130,000 square yards per annum. Besides large areas in the Strand, Hackney, and St. George's Districts, carried out during the present year, wood paving has also been adopted in the City, Kensington, Chiswick, Kilburn and Hampstead. Leaving out of the question the subject of cost, as one of a practical character in which the readers of the *Gardeners' Chronicle* will not be specially interested, we quote Mr. Isaacs' opinion on the relative value of coniferous woods, and those of species of *Eucalyptus*. "Taken all round," he says, "the best wood to use for this purpose is Baltic 'red timber or yellow deal, which must be thoroughly sound and 'well-seasoned, absolutely free from sap, shake, knots, or other imperfections.'" Within the last few years there has been a strenuous endeavour to introduce denser and harder wood for paving purposes, notably Jarrah and Karri, but objection is taken to these woods that they are hard and slippery and also noisy. At a meeting of the Kensington Vestry on November 8th last, a report was submitted from the Works Committee stating that complaints had been received relative to the noise caused by the trial sections of Jarrah and Karri woods recently laid in the Brompton Road, and the Works Committee recommended that the sections of hard wood in question be removed, and creosoted deal blocks substituted therefor, and after some discussion, the recommendation was agreed to. The expense of these woods is almost prohibitive, the comparison being £10 10s. for yellow deal as against £23 10s. for Jarrah, so that Jarrah would require to last seventeen to eighteen years to be equal in price to yellow deal creosoted. Another serious disadvantage possessed by wood paving is, that it absorbs dirt and street deposits more readily than any other pavement, and gives off a sickening odour, especially under a powerful sun. So that taking all things into consideration, the future of wood blocks for paving purposes

does not seem by any means ensured. In the paragraph in the *Gardeners' Chronicle* before referred to, it is stated that West Australian Red Gum is "coming to the front" for paving purposes. It would be interesting to know what species of *Eucalyptus* is here intended. The term Red Gum is applied to several species in Australia, the best known being *E. rostrata*, the wood of which equals Jarrah in strength and durability, but this species is not a West Australian one. The true Red Gum of West Australia is *E. calophylla*, but this wood, though used for many above-ground purposes, has a bad reputation for under ground work.—(*Gardeners' Chronicle*.)

THE INDIAN FORESTER.

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[No. 4

The Hill Forests of Java.

a.—THE VEGETATION ON THE PEAKS OF JAVA.

The highest summit in W. Java attains an elevation of 9,326 feet and forms a plateau with a central depression, the crater of an extinct volcano. This plateau is occupied by bushes 8 to 10 feet high, and is covered with a short turf, whilst the slopes 500 feet lower show a thick but not tall forest growth: below this again there follows a region where the vegetation gradually approaches that of the cloud zone.

Local influences affect the character of this region even more than the elevation, otherwise these forests might be treated of as sub-Alpine; for instance, the meadows, which, though not so marked as in East Java, should yet show in the most marked way the alpine characteristics of this area, are often found not above but below the forest limit. But these forests, on the other hand, possess the characteristics so peculiar to high elevations, namely (1) that of crooked and knotty growth, the stems being short and thick, crooked and often horizontal, with twigless branches which twist in every direction and bear a few leathery leaves at their extremities: (2) the umbrella formation of the crown, built up of many branches and scanty foliage: (3) the relative proportion of foliage and timber which in the cloud zone altered in so marked a manner, is here even still more evident and is more noticeable even than in Europe: (4) the trees are covered with thick layers of moss, but not so profusely as in the lower region; and amongst the moss a few small ferns and epiphytes, and a small red-flowered orchid with thick leathery leaves and large roots is observable. The same varieties are present, but in much greater number in the cloud region. It is difficult to recognise the various species for although the forests are not dense, the confusion of twisted boughs and dead wood is amazing.

Aralia, *Myrsine avenis*, *Vaccinium floribundum*, *Dicalyx sessilifolius* and a *Hypericum* are common, whilst the giant

Edeliveiss *Anaphalis javanica* forms large bushes inside the crater. The ground is not well covered under the twisted forest growth; there is a dense layer of dead leaves from which the yellow and red spotted flowers of *Balanophora elongata* appear. A few ferns, a white orchid, *Ranunculus*, bushes of a Cyperacea, some grasses and brambles, flourish here and there between the tree trunks whose bases are surrounded, when not covered with moss, with the beautiful *Nertera depressa*. In open places where the sunshine can penetrate, the vegetation is more luxuriant, and here are whole beds of *Primula imperialis*, only found on this mountain peak, which reaches a height of 3 feet and bears 3 or 4 flowering heads; other flowers such as *Sanicula montana*, *Ranunculus javanus*, *Ophelia javanica*, are also found, and the stems of *Crawfordia* twine on the tree trunks.

The woody growth in this region attests the dryness of the atmosphere, whilst the undergrowth shows the presence of more moisture. The bushes which grow on the summit of the mountain, show, in a still more marked degree, the absence of moisture, they are generally evergreens with hard, thick, hairy leaves. The most common of these are *Anaphalis javanica* (which, however, has soft leaves) *Vaccinium varingiaefolium*, and *V. floribundum*, *Rhododendron retusum*, *Gaultheria punctata* and *leucocarpa*, *Myrsine avenis*, etc.; there is also a small climber *Lonicera oxylepis*.

Tree ferns (*Cyathea* and *Alsophila*) with massive stems, reach as high as these bushes, whilst these again are overtopped by specimens of *Leptospermum floribundum* whose umbrella-shaped crown is covered with white myrtle-like blossoms.

There are no Epiphytes, the bushes are only occasionally moss grown but lichens are numerous. This distinction between tree and shrub growth is, of course, attributable to the falling off in moisture in the localities where shrubs abound. Herb growth consists of *Plantago Haskarlui*, *Myriactis pilosa*, *Ophelia javanica*, etc., and of large ferns such as *Aspidium aculeatum*, *Lycopodium*, sp. The open meadow land near the crater bears scattered bushes and patches of a grey white hairy moss, (*Racomitrium*); in these fields of moss the truly Alpine *Gentiana quadrifida*, *Gnaphalium javanum* and *Veronica javanum* exist.

b.—THE VEGETATION ON THE PEAKS OF EASTERN JAVA.

The characteristics of the vegetation towards the summit of the mountains in Eastern Java are similar to these described in part 2 b. of these notes; tree growth and species remain the same up to the upper limit of vegetation, where appear *Vaccinium Miquelii* and a few Ericaceæ. With a rise in elevation the *Casuarina* lose in height and become gnarled and the same is the case with *Quercus pruinosa*; the boles of both these trees become shorter, the branches twisted, the crown flat, whilst the foliage diminishes greatly.

Tree growth ceases very suddenly, and forest is replaced by open meadows on which clumps of a small leaved grass flourish, this is probably *Festuca nubigena*. Between these clumps the soil is either bare or covered with the creeping small hard-leaved *Leucopogon Javanica*, which may be met with at lower elevations in the Casuarina forest, and with *Festuca* forms the chief vegetation of this region.

Besides these, *Alchemilla villosa* with small hairy leaves and an enormous rhizome; *Pimpinella Pruatjan* with small stem and massive roots; *Polygonum paniculatum*, *Wahlenbergia lavandulæfolia*, a small violet, and two true Alpine plants, *Gnaphalium* sp and *Gentiana quadrifida* may be observed. The only plant with a large flower is a fine *Hypericum*. In clefts in the rock and similar places, one may remark specimens of *Casuarina* and *Vaccinium* knotted and stunted by the climate. On the highest peak two shrubs, *Photinia intergrifolia* and *Coprosma sundana* exist, from whose green bell-shaped flowers the long stamen or pistil protrudes.

It will be evident that the vegetation of the mountain peaks in Java is somewhat similar to that of the Alps and Pyrenees. The diminution and final cessation of tree growth, the increase of the bole and decrease of the foliage, the presence of a crooked and twisted growth, the remarkable growth of the root—all point to the existence of an Alpine flora which formerly suffered from a rigorous climate, an excessive snow fall, and the shortness of the period of active vegetation, whereas at present on these mountains there is no break in the period of vegetation, no snow fall, and only occasional frosty nights.

We can only seek for the causes of the appearance of these characteristics of an Alpine flora in the vegetation of the mountains of Java, in the circumstances which are common both to these and European mountains. Such circumstances are the rarified air, the great power of sunlight and the dryness of the atmosphere; all these are factors which with increasing evaporation render more difficult the supply of water necessary to plant life. A closer investigation of the anatomical structure and a comparison of Alpine vegetation with that of dry places, for instance that of deserts, proves that the requirements in moisture of trees and shrubs at the highest elevations is alone the cause of any peculiarity in structure. This is further proved by the fact that the presence of Alpine flora in Java is only noticeable where there is a great scarcity of water. Thus, in the cloud and moist zones of these forests, a number of the species present in the upper forests exist as epiphytes on the dry trunks of trees but not on the ground itself; but are found on the ground so soon as the soil contains a large proportion of salts which necessitate a large consumption of water by the plant, as on the sea shores.

A. F. W. SCHIMPER,

(In the *Forstlich-naturwissenschaftliche Zeitschrift*.)

Seeding of *Strobilanthes* on the Nilgiris.

All species of *Strobilanthes* with the exception of three, have flowered and seeded on the grass lands and Sholas of the Nilgiris. The common *Strobilanthes* first began flowering in 1892 and by March 1893, the hill sides were covered with dead bushes and the ground with seeds.

The shade-loving species next commenced to flower in 1892 and the Sholas were gay with the bright, blue, pink and violet blossoms, which attracted swarms of bees from the great forests of the Wynaad. The large bee *Apis dorsata* was especially abundant, immense swarms settling on the Blue gums in Ootacamund and building their combs on them, and on every precipice along the verge of the Ghats. The honey, though fairly well flavoured, was dark and treacly looking. Most of these bees at high elevations, perished during the frosts of January and February 1893, and the ground, in places, was covered with their dead bodies.

There was a general migration of jungle fowl from the Ghat Sholas, as soon as the seed was shed, and I counted no less than 42 in one covey and 18 in another, all busy feeding on the fallen seeds.

The Sholas are now full of the dead and fallen stems and it is a work of great difficulty to force one's way through most of them. The danger from fire has been great, and it was necessary to burn off the grass round the edges of most of the Sholas to prevent fire from entering.

The ground is now covered with seedlings from 1 inch to 6 inches high.

R. M.

Forest Offences.

In its review of the administration report of the Presidency Forests for the year 1891-92, the Government of Madras, referring to the high percentage of acquittals in some of the Districts, remarks thus :—

“ The figures for these Districts are most unsatisfactory and ‘ probably evidence, as the Board points out, trumping up of ‘ charges by subordinates and neglect on the part of District Forest ‘ Officers to enquire into cases before directing the institution of ‘ prosecution.” The high percentage of acquittals inclines the Government to come to two conclusions, to wit, (1) that charges are trumped up by forest subordinates, and (2) that District Forest Officers do not inquire into cases before they are prosecuted.

The question of forest offences and their treatment is one of very great importance and in fact "there is no matter connected with its (Forest Department's) working that demands closer 'attention from all who are connected with its administration'" as the Editor of the *Madras Mail* observes in one of his leading articles. It therefore deserves to be more fully treated than my limited knowledge and experience will allow, and I, therefore, submit the following few remarks, in the hope that some abler and more experienced Forest Officers will discuss the subject, more fully, in the pages of the *Indian Forester*.

Now, to discuss the above two conclusions of the Madras Government. As regards the first, all that I wish to say is that there are other causes than the mere falseness of a case that may account for acquittal. One of these causes is the easy tampering with the prosecution evidence. Although this explanation was deemed unsatisfactory by the Conservator, the Board and the Government, yet it is a fact that several cases fall through by this cause. For it is rare that a Forest Officer meets with a respectable and truth-loving man in his forest when he detects an offence. It will generally be an ordinary ryot if at all, probably a neighbour of the offender, that may have witnessed the offence, and it is this man that is cited as a witness. I leave it to your readers, especially such as have frequently dealt with the detection and prosecution of forest offences personally, to say whether a ryot is likely to be favourable to the Forest Department, which he looks upon with no ill-concealed hatred and aversion, or whether he is likely to help his own neighbour, and that, too, under the pressure of his village head and of the influential members of the village, which is sure to be brought to bear upon him. If the witness is devoid of neighbourly feelings or is proof against any pressure from an influential quarter, then is applied the pressure of that charm-worker money. To secure a man who will withstand the above influences is to seek for a truth-loving and honest man, and where is the Forest Guard or his Watcher to find such a man in the midst of a forest? I have had many a true case in my short career, which fell through by this cause.

The second cause is the apathy, or rather the want of sympathy, of the Magistrate who tries the cases, with the Forest Department. As a rule, it is a Subordinate Revenue Officer, who is generally also a Magistrate, that hears Forest Offence cases. As a Revenue Officer his sympathies are more with the ryot classes than with the Forest Department, which he generally believes to be very tyrannical and oppressive. Moreover, he has reason to look upon the Forest Department with some aversion at least, for it has snatched away from him the almost unbounded control he once had over the jungles in his jurisdiction, prior to the advent of that Department. Happily, this state of feeling is gradually and rapidly subsiding under the influence of education, and a better

understanding of the Forest Laws and their beneficial objects is gaining ground among Magistrates.

The third cause may be insufficiency of evidence. This is easily understood when it is remembered that a forest offence is generally committed in a forest where there are not likely to be any persons besides the forest subordinates. In many cases, the detector may be the only person who saw the commission of the offence. In such cases, only the evidence of forest subordinates will be available. It is natural that the Magistrate should feel diffident to convict a person on the uncorroborated testimony of a low paid guard or watcher, even though the case may be perfectly true.

From the foregoing, I hope I shall not be understood to offer any hostile criticisms on the remarks of the Board and Government. I am far from it, especially when I know that it is only natural that such a conclusion should be arrived at by any one who notices such a large proportion of acquittals, unless they are accompanied by a different explanation. It is unfortunate that this high percentage of acquittals was not explained fully in the District reports. My object in writing at this length on this point is simply to point out that there are circumstances other than the mere trumping up of charges that may bring about the acquittal of forest offences.

From the above remarks, I do not mean to say that Forest Subordinates are incapable of trumping up cases, although I heartily wish I could say so. On the other hand, many of these acquitted cases may have been trumped up ones. It is not altogether uncommon for forest guards who are low paid, to cook up a case against an individual who has refused them a meal or *buck-sheesh* on a festive day. But that it is a general practice is hard of belief.

The main point to consider is, how to minimize the percentage of acquittals of forest cases? The obvious answer is to hold a preliminary inquiry into every case departmentally and if its result shows that the case is true and will stand magisterial inquiry, then only to institute prosecution. This leads to a discussion of the second conclusion at which the Government has arrived.

Now as regards inquiry into cases by District Forest Officers, the Government is pleased to believe that no such inquiries are held, and that District Forest Officers neglect their duties in this direction. It is true that preliminary enquiries are not generally made by District Forest Officers before cases are sent up to Magistrates for trial. It seems to me that this is because it is not possible for a District Forest Officer to enquire into every case in his District personally, even if he can afford time to do so, with his thousand and one other duties. It is not in one place and at one time that all the forest offences are committed in a District in the course of a year. Offences occur all round the year and in all

parts of the District, and I am sure that the Board and Government would not have their District Forest Officer run about his whole District, and at all times when offences are reported, to enquire into them for reasons too obvious to require explanation. Even supposing that this were possible, what length of time would elapse between the date of detection and that of complaint to the Magistrate which could only be lodged after the District Forest Officer's enquiry into the case? For all I know, it may be several months. Cases taken to Magistrates after such long delays have fewer chances of success.

It is clear from the above remarks that it is impossible for District Forest Officers to enquire into all forest offences reported to them by their subordinates before the institution of prosecutions.

"Why do not then," it may be asked, the Rangers and Sub-Divisional Officers enquire into cases before they submit their subordinates' crime reports to the District Forest Officer for orders? My object in intruding upon your readers with this article and of craving a space for it in your Journal is to excite a full and exhaustive discussion of the answer to the above question. The only answer that can at present be given to it, is that Range Officers (including Sub-Assistant Conservators who are not in independent charges of Districts) are not competent to hold inquiries into forest offences and hence the omission on their part to enquire into cases.

Taking the latest revised Rules published under section 63 (a) of the Madras Forest Act by the Government of Madras, we find there, that it is only District Forest Officers that are competent to summon witnesses and to hold enquiries into forest offences, &c. This means plainly that the subordinates of District Forest Officers, whatever their rank and grade, are incompetent to enquire into cases, and enquiries made by them are therefore illegal or at any rate not sanctioned by law. Someone of your readers may say "what if the Subordinates Officers are not legally empowered to 'enquire into cases; they can surely examine the parties concerned, 'take notes for their satisfaction, and report the case to their District Forest Officer with the result of their examination.'" This may be done only when parties care to appear before such officers and even if they appear, only when they answer the question truly and honestly. Supposing they refuse to appear before subordinates without a formal summons, or to answer questions put to them, or give false and incorrect information. What then? What sections of the Forest Act can be resorted to for punishing them? None at all. I doubt ever if any provisions of the Penal Code can be applied to such cases. These are not mere imaginary difficulties, for I have had to report upwards of 700 cases within my short career in the Department as a Forest Ranger, and in several cases I could not secure the parties to come and say before me what they knew of them, even though I went to their villages, served written notice on them to appear before me and so on. These difficulties are more

clearly and keenly felt in those places where there are half educated persons who know something of Forest Law.

I hope I have made it pretty clear from the foregoing remarks, that it is owing to a defect in Forest Law that cases have to be sent up to the Magistracy without any departmental preliminary inquiry into their merits, and that the existing provision to enable a departmental enquiry previous to recourse to a Court of Law is insufficient and impossible to be practically worked to the required extent. The defect I refer to is obviously the provision in the existing Forest Law empowering Range Officers and Sub-Divisional Officers *to summon parties and to enquire into forest offences.*

This leads to a consideration of the expediency and advisability of investing Forest Range Officers and Sub-Divisional Forest Officers with the powers of (1) compelling the attendance of witnesses, &c., and (2) holding inquiry into forest cases, powers which fall under section 160 and 161 of the Criminal Procedure Code. If the Government is determined to put a stop to this high percentage of acquittals it can do so only by insisting upon the Forest Department sending only such cases for trial as are in all probability certain of conviction. To ascertain this is to institute Departmental enquiry into every case. To expect this to be done by the District Forest Officer himself personally and unaided is to expect an impossibility as has been already pointed out. It therefore comes to this that the Subordinate Executive Forest Officers must be placed in a position to conduct these preliminary enquiries by being invested with the needful legal powers. I feel no doubt that the Government would not only consider favorably a proposal to invest the Executive Subordinates with such powers but that it would also grant the same, if the matter is properly represented by the competent authority *i. e.* Conservators in consultation with Collectors. I do not in the least think that Government would object to such a proposal on the score of abuse of the powers by subordinates, for in other Departments, officers of lower rank and pay than Forest Rangers of higher grades, such as Head Constables of the Police and Sub-Inspectors of the Salt and Abkari Departments are not only invested with the power of summoning parties, but in the case of Head Constables are empowered also to hold preliminary enquiries into cases. Moreover, is it likely that the Government would show a want of confidence in its Forest Rangers and Subordinate Forest Officers of higher ranks by refusing to entrust them with these powers which can hardly be turned into weapons of oppression, when we remember that it has entrusted them with the more responsible power of arresting persons for breaches of Forest Laws.

The subject is one of much importance and deserves to be fully discussed. I hope that an earnest discussion of the subject will be started in the *Indian Forester*, and that it will bear good fruit.

KASSAU.

Influence of the removal of humus on the Vegetation of Forests.

(*Translation from the Revue des Eaux et Forêts.*)

It may be interesting to compare with the experiments carried out in the German experimental Forest Stations (vide Vol. XIX Ind For.) a scientific fact which may be found in the records of the Academie des Sciences.

M. M. Berthelot and Schlösing, Muntz and Condon have made experiments, agreeing with each other, which show that the presence of nitrogen in the soil is exclusively due to the action of micro-organisms, microbes and moulds and that bare soil or soil destitute of organic matter does not fix nitrogen.

In a forest one has frequent opportunities of noticing how the upper layer of mould and dead leaves favours the propagation of moulds and consequently of ammoniacal fermentation. It is then easy to imagine how the removal and even the simple reversing of the layers of dead leaves not only hinders the formation of mould but even diminishes the amount of nitrogen fixed by the soil by preventing the development of micro-organisms.

The influence of the humus on the quantities of nitrogen contained in a soil is already known from experiments recorded by the Eastern Agricultural Station. The results of these experiments are as follows

PROTECTED SOIL			Kilogs of Nitrogen per Hectare.
Upper layer	...	...	242
Middle „	...	...	2,110
Lower „	...	...	6,002
UNPROTECTED SOIL			
Upper layer	...	...	26
Middle „	...	...	1,073
Lower „	...	...	3,660

Young trees require more nitrogenous matter than old ones and these latter penetrate deeper into the sub-soil and lower layers which contain more nitrogen than the upper layers. For these two reasons the removal of the covering of dead leaves must necessarily have greater influence in the case of young crops.

This explains certain peculiarities which have often been noticed. For example, in such places as the neighbourhood of houses bordering on or inclosed in the forest, the small areas of coppice which have to bear the exercise of rights appertaining to proximity such as the passing to and fro of the inhabitants and their cattle and carts, invasions of poultry, &c., the same symptoms of languishing vegetation are observable.

in every case it is less vigorous than in the adjoining forest, the stems are smaller, covered with lichens, and with a feeble crown. We have the same phenomena in those parts of the forest which are nearest to villages where grazing is heaviest and this notwithstanding the fact that here as in other parts of the forest grazing is prohibited until the coppice is 10 or 12 years old and that the dead leaves are not removed. It is simply that the surface covering of the soil is constantly being disturbed, kicked up and scattered about by the passing and repassing of men and cattle, and moving about is easy in these crops where the undergrowth is scarce. The result is no rotting or production of moulds, and at the same time little nitrogen and little vigour.

This reminds us of a petition addressed to the Chamber of Deputies about 1884 or 85 by the mayors of the arrondissement of Graz. Among other things the municipalities asked that the coppices might be thrown open to grazing after the age of 5 years, a practice which would carry with it the advantage of cleaning the young crops and destroying the parasites. Perhaps now that the most celebrated chemists of France are on his side, people will now listen more willingly to the Forest Officer when he endeavours to protect these same desirable "parasites."*

L. DETRIC,

* Strictly 'saprophytes' in the *Rèvue des Eaux and Forêts*.

Note on Extraction of Agave Americana
Fibre at Coimbatore.

When on tour in the Madras Presidency in 1892 I was much struck with the excellent quality of the fibre of *Agave americana*, which was exposed for sale in many shops in the Coimbatore bazar.

A small quantity of the fibre was sent for report to the Imperial Institute, in connection with which I was at that time engaged in the investigation of fibres of Indian production which are, or might be, utilized for brush manufacture.*

Quite recently, the Madras Agri-Horticultural Society received a communication from Dr. T. Cooke, Technical Sub-Director of the Imperial Institute, South Kensington, stating that fibre of *Agave americana* (grown, I take it in the gardens at Madras) has been very well reported on, and is considered to be nearly as good as Manilla hemp.

The only specimens of fibre of *Agave americana* which were sent to the Imperial Institute from the Madras Presidency were those obtained by myself at Coimbatore, which must be those which have been thus favorably reported on.

Dr. Cooke's letter to the Agri-Horticultural Society was communicated to me, together with a series of questions by a fibre expert, I accordingly deputed the Museum Herbarium Keeper to visit Coimbatore and gave him specific instructions as to the nature of the inquiries which he was to make. The result of his inquiries *in loco* is embodied in the following note—

Agave americana grows in all soils (red, black and gravel) in the Coimbatore district. It is planted extensively as a protective hedge along the Madras Railway line, and flourishes, in the open, freely exposed to the sun, and unsheltered by trees, shrubs, &c. In some places between Coimbatore and Erode where the agave is overgrown with creepers, the plants are unhealthy; and in other places (*e.g.*, near Tudiyalur), plants which are shaded by tamarind, nim and other trees, are stunted, while those which grow in the open, are rich in leaves and luxuriant in growth.

The age of the plants from which the leaves are taken for fibre is six to seven years. The old green leaves falling outwards from the central stem are cut for fibre.

The fibre is, as a general rule, extracted immediately after the leaves have been cut, or after a lapse of a few hours. Sometimes, however, the leaves are kept for a day or two and the fibre is extracted when the people have leisure.

The extraction of the fibre is performed by hand and no machinery is used. The fibre is extracted by two methods, *viz.* (a) scraping and (b) maceration.

(a) *Scraping*.—The leaves are cut, the sharp spines removed with a knife, and about six inches cut off for the top of the leaf. The leaf is then split longitudinally into four or five pieces, which are beaten with a wooden mallet and placed on a board 4' x 4" x 3" held firmly by the toes. The pulp is then removed by means of a bamboo scraper, one edge of which is shaped in the form of a blade, and the fibre dried by exposure to the sun.

* See Imperial Institute, *Hand-book of Commercial Products*, No. 12, Fibres used for Brush-making.

The fibre obtained by this simple process without washing or bleaching is very clean and free from pulp. The staple is not, however, very long. It is made into thread, which is used in weaving grass mats.

(b) *Maceration*.—As in the previous method of fibre-extraction, the leaves are cut, and the spines removed. The whole leaf is then beaten with a wooden mallet, and thrown in bundles into tanks or wells, in which it is left to macerate for a fortnight to twenty days, or until the pulp is quite decomposed. The bundles are then taken out, dried and bleached in the sun.

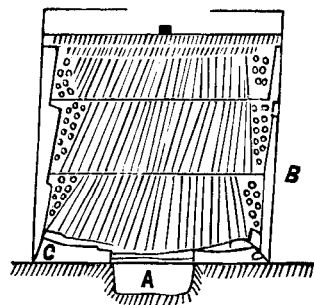
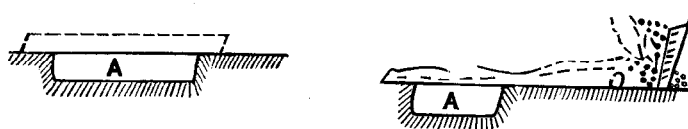
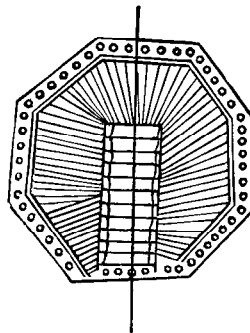
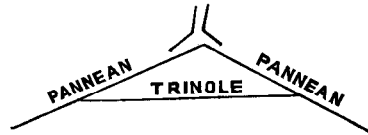
The fibre obtained by this process is longer than that obtained by scraping, but is not nearly so clean.

A very large supply of the fibre could be obtained, if a demand for it arose. At present it is sold in the bazar at the rate of 2 annas per lb., but if a regular trade in it were started, the price would doubtless be reduced.

The mean temperature of Coimbatore is 78° ranging between a maximum of 97° and a minimum of 64°. The annual rainfall of Coimbatore is about 21 inches, of which half falls during the north-east monsoon (October to December), the remainder being distributed over the other months of the year.

(Sd). EDGAR THURSTON,
Superintendent, Govt. Central Museum.

THE MOREAU PATTERN CHARCOAL KILN.



The Moreau Pattern Charcoal Kiln.

Description.—The Moreau oven is constructed entirely of sheet iron having the form of a right octagonal prism composed of eight panels 2 M. 50 c/m (8·2 ft.) in height by 1 M. wide (3·28 ft.).

These panels are fastened together by means of key bolts which fasten brackets rivetted round the edge of each one of them.

One of these panels is cut into two parts near the middle of its height; this is the “door panel” which facilitates the putting in of the wood. The two perpendicular panels forming the door are reunited by two solid T. irons supporting the four plates constituting the lid of the oven. These plates which rest simply on the T. irons and on the brackets fixed to the top part of the panels leave in the centre a hole about 50 c/m square which is closed with a lid of thin sheet iron provided with a handle; they have besides 4 round holes called “Buses” which are also closed with little plates of sheet iron.

Four of the panels diametrically opposite have on the outside chimneys communicating with the interior of the apparatus through the bottom by means of a rectangular opening.

In the axis of the chimneys are iron rods provided with funnels. The lower extremity of these rods is fixed in pieces of wood forming supports.

At the bottom part of each panel there are two air pipes in the form of funnels. In each of these 16 funnels is placed a globular ball pierced with a conical hole into which penetrates a piece of wood placed in the interior of the oven; when this branch or piece of wood is carbonized it breaks, the ball falls to the bottom of the funnel thus making an automatical closure.

The closure of the chimneys is worked automatically in the same manner.

Carbonisation.—The carbonisation of the wood by the Moreau process consists of seven operations which must succeed each other in the following order.

1. Preparing the ground.
2. Fixing up the oven.
3. Choice and dimensions of the wood.
4. Filling the oven.
5. Putting in the fire; heating it.
6. Cleansing and extinguishing.
7. Emptying the oven.

1. *Preparing the ground.*—The ground must be level and on the natural soil, the mole holes must be well stopped up so as to prevent the air from coming in.

A trench must be dug in the centre of the ground occupied by each oven, this trench must be long enough to be able to introduce from the outside the necessary charcoal for lighting it. If, after several bakings, the soil of the ground becomes too dry or too hot it should be watered, or sprinkled with green grass or wet moss, otherwise there is a danger of having very soft charcoal.

2. *Fixing up the Oven.*—The apparatus is fixed by means of 16 rods of 50 c/m (of which 8 are at the top and 8 at the bottom). A series of rods serve for setting up all the ovens, these rods are provided with hooks fixing into screw rings rivetted to the panels. The latter are thus kept in their vertical position and in the inclination which they must have one with regard to the other in order to form an octagonal section of a prism; the junction is completed by means of little key-bolts, the rods are then taken away. The seams must be stopped up with earth as well as possible.

The foot of the oven is surrounded with dry earth as the smoke ought only to come through the chimneys, care must be taken that they are not stopped up. This can be ascertained by passing through them the handle of a shovel and seeing that it goes freely

to the bottom. The little pieces of wood supporting the clappers of the chimneys ought not to be more than 12 c/m in height by 3 to 4 c/m in diameter. Those pieces of wood in the balls must be 1 c/m in diameter by the necessary length.

The clappers of the chimneys must enter into them a few centimetres and their plain sides must be laid against the face of the panels.

3. *Choice and dimensions of wood.*—To obtain charcoal of a good quality consistent with a good yield, it is necessary to split the wood more than 6 to 7 ($2\frac{3}{4}$ inches) centimetres of its diameter, and if possible it must not be baked until after it has been felled three months.

Rotten wood must never be used for carbonisation.

4. *Filling the Oven.*—The apparatus having been well cleaned and examined, if the soil be hot and dry a few leaves or some wet moss should be spread over it and once or twice sprinkled with water; the floor of the oven must then be formed.

Place on the lighting trench a series of pieces of wood and all round pieces slightly inclined and radiating around the centre.

Above the floor, which must be about 15 c/m thick, place the logs of wood starting from the centre and proceeding to the circumference. It is essential to take a special disposition in the conical zone which the wood leaves between the different beds and the walls of the oven in order to allow the products of the condensation, the tar, &c., to flow away and at the same time to allow the gas and fumes to escape.

In order to effect this, place at the back of each panel 6 or 7 pieces of wood of medium size and as straight as possible and fill the intervening space with logs of wood placed horizontally.

The inferior wood must be placed as far as possible in the first row and on the floor.

The first row being finished, the bottom panel door is put into its place. The two other rows must then be arranged: on the top of the last row, place rather damp leaves, moss, or litter, which must be of 8 to 10 c/m in thickness. The T irons are then put into place and on the top the iron sheets forming the roof of the oven.

5. *Putting in the fire: heating it.*—Lighting and heating it ought not to extend beyond 4 hours (by heating it, is meant the heating of the oven from top to bottom). A good heat gives always a good baking.

To succeed in these operations, the fire may be allowed to give a certain intensity of heat at first without fear of evil result. It is well to obtain as much white smoke as possible which must have exit wherever it is produced: yellow, gray or blue smoke must be stopped as soon as produced by progressively closing the manhole and the lighting hole.

Light by means of an iron spoon on which is placed well lighted charcoal, which must be put in as far as the centre, through the lighting trench.

When the fire has well caught, so that the smoke comes out freely through the manhole and the holes called the buses (the chimneys are closed until they are required to draw a little), half close with earth the entrance to the lighting trench only enough to moderate the fire a little, which is soon ascertained by the colour of the smoke. In short, it is necessary to be careful that at the commencement of the operation as much white smoke as possible is produced.

At the end of an hour or an hour and a half, see that the fire is not above nor in the centre; for this purpose try to push into this place a pole, and if it penetrates this mass, it is certain the fire is above, then make what is known as the covering. For this purpose close quite hermetically the buses, airpipes, and chimneys except the manhole; by means of a strong pole, enlarge from top to bottom the hole in the centre and fill it with little pieces of wood cut 10 c/m in length, as fast as the hole fills, ram in heavily these little pieces of wood and on the top place a few handfuls of litter and a little coal dust.

This operation must be performed very quickly, it requires each time about a hectolitre of cut wood.

Arrange the oven as it was before the operation and continue the heating by closing progressively the openings, with the exception of the air pipes. If the chimneys can draw, open them with regard to the little buses shut those which smoke yellow grey or blue; but the one which is on the side of the door, must not be closed more than possible till about 2 hours after heating. If obliged to close it, it should be reopened a short time afterwards.

The cones should not be placed on the chimneys until 15 hours after lighting.

The man hole being closed and the chimneys smoking strongly, which generally happens $1\frac{1}{2}$ hours after lighting, nothing remains open but the chimneys, air pipes, and a part of the lighting hole.

Two and a half hours after lighting the fire arriving at about 25 c/m from the lighting hole, the latter must be entirely closed, but if the smoke should diminish in quantity, it would be necessary to reopen it a little for about an hour.

Four hours after lighting, the oven is heated from top to bottom, all the fissures must be closed with earth and the chimneys filled with earth up to 50 c/m above the soil.

6. *Cleansing and Extinguishing.*

For cleansing, open the man hole, heat down and make even the top of the mass. During the cleansing from time to time, look at the interior so as to put more coal dust on the planes which are too red.

As soon as the mass of charcoal becomes a dark red and if it no longer smokes, proceed to extinguish.

For this purpose, ascertain that the earth has not run down the chimneys, and if it is about 50 c/m. above the ground; bury completely the air pipes, examine likewise the upper part and then leave the oven alone for 15 to 20 hours, there will be no more fire.

To facilitate the extinction before closing the man-hole, throw on the top of the pile of charcoal three or four handfuls of green or grey litter or anything that will clear the smoke. Finally if water can be procured pour on the head of the cone of charcoal 2 water-cans full.

7. *Emptying the Oven.*

This operation must be done quickly, especially if it is windy for fear of the fire spreading. Lift up the panel door at the top, then the one at the bottom, take out the charcoal by means of a hook; charcoal should be taken first of all from the centre and then from the bottom when half a sackful has been drawn out, place it in a semicircle as far as possible from the door. The embers must be put by themselves.

The charcoal must not be put into sacks until three or four hours after it has been taken out of the oven, the longer the charcoal is left in the air, the firmer it will be and the less apt to break.

In case of fire in the centre which happens if the rotten wood has not been thrown out, or if the fissures have been badly stopped up, throw on the fire some fresh and fine earth and immediately turn out the charcoal.

The emptying of the oven must be fully completed before leaving it.

General Rules.

1. The ground must always be level and rather slightly damp than dry.

2. Wood which is more than 6 to 7 c/m. in diameter must be split and in spite of the outlay which this work necessitates, there is a very great advantage in performing it not only with regard to the quality, but also for the sake of the yielding.

3. The smoke must always be white, except towards the end of the operation when it becomes blue.

4. From the time of laying the fire to the extinction thereof, not more than 30 to 36 hours should elapse.

5. A good lighting and a rapid heating is very essential, it is the secret of the operation.

6. When once the lighting hole and the buses are well closed, avoid any draught going through the mass.

J. W. CHERRY.

Letter No. 1898 dated 25th November 1893, from O. Wolfe Murray, Esqr., Collector of Nilgiris, to the Conservator of Forests, S. C.

With reference to your letter No. 1801 dated 18th August 1893, I have the honor to furnish you with the necessary information.

A copy of the instructions received from the Director-General of Stores, London, is enclosed, which gives a description and plan of the kilns.

2. One kiln was obtained in 1886, at a cost of Rs 627-7-11, delivered at Coonoor, and 2 more arrived in December 1890, at a cost of Rs. 1,345-13-9. These are now in the Ootacamund Range.

3. All three were used for burning charcoal and acacia wood were used.

4. From October 1886, up to the end of March 1893, 1,928,100 lbs. of wood were burnt in the Kiln at Coonoor which yielded 309,754 lbs. of Charcoal or 19.06 per cent. The cost of working including the value of the wood, wages of burners, &c., amounted to Rs. 4,020. The interest on the outlay and the cost of supervision has not been added, also repair charges, amounted to Rs. 150. This kiln is now almost worn out.

In the two kilns at Ootacamund 4,389,875 lbs. of wood were burnt from December 1890, up to the end of March 1893. 734,384 lbs. of charcoal were produced-17.7 per cent. The cost of working was Rs. 7,831 and the value of the charcoal Rs. 9,835 the profit being Rs 2,004. The bottom portions of these Kilns are worn out and brick protecting walls have had to be erected.

The native system of manufacturing charcoal has not been successful. The out-turn of charcoal to the wood used seldom exceeds 11 per cent and the cost of making the kilns and wages of the burners exceed the value of the charcoal produced.

The Moreau kilns are the best portable kilns extant; but if the sheet iron of which they are made were thicker, they would last longer, as it is, the iron burns out at the base after a few years' work.

Mr. Morgan has invented a charcoal kiln made entirely of bricks which only costs Rs. 70 and produces quite as good an out-turn of charcoal as the Moreau kilns. These brick-made kilns are now largely used for the production of charcoal in the District.

NOTE.—The above papers have been sent to us by the Inspector-General of Forests for publication. We think it right to mention that the introduction of the Moreau Kiln was due to our own arrangements when in charge of a Circle in the Madras Presidency. The successful working of the Coonoor Kiln was primarily due to the pains taken by the then Ranger Mr. Nullasacomy Naidu.

HOM. ED.

IV.—REVIEWS.

The Protection of Woodlands by Dr. J. Nisbet.

We have received, by the kindness of the translator, a copy of his book "The Protection of Woodlands" a translation from the German work of Dr. Hermaun Fürst, Director of the Bavarian Forest Institute at Aschaffenburg, and we have found it very interesting. In his Preface, Mr. Nisbet tells us that after considering whether a short manual on the subject would not be desirable, he came to the conclusion that a translation of Dr. Fürst's work, arranged for the fourth edition of Dr. Kauschiger's 'Lehre vom Waldschutz' would probably be of practical benefit to sylviculturists in England and Scotland, and most particularly in drawing attention to the dangers of *pure* forest, so liable to insect and fungoid diseases.

The *first section* treats of the Protection of Woods against injuries due to inorganic agencies, such as frost, heat, rain, snow, storms, lightning and also from unfavourable soil and situation. All these are carefully treated one by one, *their effects upon the principal trees* are studied and described, and preventive measures are suggested as well as remedial ones where such are possible. The recommendations seem good and practical but we venture to think that in speaking of the precautions to be taken to prevent the fungoid infection at page 62 there must be some mistake and that with storms coming from the westward it is on that side of the infected area that nurseries should be placed, if the carriage of spores from the forest to them is to be avoided.

The *second section* treats of the Protection of Woods against agencies, such as weeds, parasitic plants, and animals of all kinds especially destructive moths and beetles. This notice, as may be expected, occupies much the largest part of the work and contains a large amount of valuable and useful and interesting information. There are a few plates of the most important of destructive insects, but we should have liked to have seen more figures and to have had these in the pages of the work and not relegated to the end. To those who have not specially studied entomology, good pictures are of the greatest assistance.

The *third section* and last, treats of the protection of Forest boundaries, the protection against misuse of rights, against forest offences, against fire, and against damage from smoke and atmospheric impurities.

The book is well got up, it is published by David Douglas of Edinburgh and is dedicated to our Inspector-General of Forests, Mr. B. Ribbentrop C. I. E. The print is very good and though we are scarcely well qualified to judge, the translation seems excellent. Here and there we have noticed phrases which are slightly German in style and some of the words used are rather doubtful, for instance 'cortaceous bark,' which occurs more than once, seems a curious phrase and is not very clear, indeed we doubt if the word is an admissible one for the Latin word is properly 'corticeus.' However, this is a very small matter, and we congratulate Mr. Nisbet upon a successful piece of work that must have occupied a considerable part of the time of his furlough.

THE INDIAN FORESTER.

Vol. XX.]

May, 1894.

[No. 5

Alluvion and Diluvion.

In the *Indian Forester* for February 1894, a correspondent (G. E. M.) on the subject of "Protected Forests," (p. 59) asked a question about the *Rule of alluvial additions to Forest estates*, which I will endeavour to answer, as he requests. I have not heard yet of any attempt to replace the old Bengal Regulation XI of 1825, which is still the General Law on the subject.

ON ALLUVION.—The defect of this Regulation is, that it allows its own rules as to ownership to be over-ridden in all cases where there is any other rule of *local custom*. Now, in a country, like the Panjáb or Sindh, where there are many rivers, or at any rate a great deal of river action going on, there are pretty sure to be *customs*, and these customs are usually very various and quite unsuited to modern requirements, such as the local customary rule that the 'deep stream' was always the boundary, and that a man lost his land if the river changed. Clearly this was due to old days of feuds and wars, when the owners were kept from each other's throats only by an unfordable stream between them! And the customs were, in fact, invented in old days, when, owing to the hostility of tribes, villages and petty States or kingdoms, special arrangements were needed, in case a village separated at one time from its neighbour by a stream should become united to it by that stream changing course. But I cannot go into the whole subject of alluvial law, and will come at once to the particular point in question.

The action of rivers coming down from the hills on to comparatively soft and nearly level alluvial plains is not difficult to understand. They have no real bed, for at least a part of their course: as they rise with the melting of mountain-snows or the 'monsoon' rains, they spread abroad and again decrease splitting up into a number of branches in so doing, because tendency of the main stream, laden with alluvial mud, is always to pile up the central bed to a slightly higher level than the sides. This level being overtopped in a high flood, the water

away on this side and on that as the obstacles of nature and the lines of least resistance suggest. Practically, two chief results are found to affect riverain property. In the one case (1) small and gentle accretions of soil are found to form up in front ('mahâz' is the native term) of the existing front; or the reverse action may take place, and little by little the area is cut away. Or, (2) a more marked change may take place, which the old Roman writers fancifully called 'avulsion': here the land itself remains, (except so far as its surface may be swept over and injured); what happens is that the stream which before flowed in *front* of an estate now flows *behind* it, or on some other side; and hence what was once a river bed, becomes (in time) dry land, and two estates formerly separated are now close neighbours; and here probably the deserted bed will be divided between them. Of course it is not possible that an area on one side of a river should really be torn off, and float houses, trees and all over to the other side, though this is implied by the word 'avulsion,' it is the river course that changes, not the land.

Of course it is not always easy to tell what is going on. For a stream may really be changing its course, and yet do so little by little that the changes appear to be cases of accretion and diminution, and each flood-season takes the water a little further; with the effect that the—(A) Estate on one bank seems to be (at the moment) only gaining a little by accretion, and the opposite estate (B) losing a little: but in time, the whole of B is gone; and if the river continues retreating, A has now become increased by the entire area, which was once B, or at least by so much of it as is not still occupied by the new course of the shifting river. It is in a case of this sort that the question noted by your correspondent arises. It has also frequently occurred, in cases when the *general* direction of the river has not suddenly altered, but still there is a slight tendency to move one way or the other locally. In such a case there may be two villages X and Y; at present Y is the riparian (or riverain) village and X is just behind it (inland), and therefore has no river frontage; but as the river slowly changes, Y is gradually eaten away, and in time X *becomes* the riparian. After a time a reverse action sets in, and the water slowly retires from X, or in other words new soil appears on the river front little by little.

Now the ordinary and well-known rule of law is that an accretion or "accessory" follows the same right of property as the principal. If a tree is mine, so (in the absence of express arrangements otherwise) is the fruit; and so will a cow and its calf. On exactly the same principle, a gradual accretion of mud, which time hardens on to my frontier and increases my area is in legal an 'accessory.' It seems to come out of the river bed; actually the estate opposite (on the other side) may not be diminished, for a corresponding loss may be going on

somewhere else and in several places. The object of the procedure for constituting a State (Reserved) or Protected Forest, is not, of course, to *create* proprietary right in the Government where it did not exist before (I mean in general; for part of the procedure may be to obviate inconvenience by buying out little plots of private land and so acquiring the whole, and creating a proprietary right, but I refer to the effect on the area as a whole), but to define its limits, to dispose of claims to easements and other rights which might, if unknown and unprovided for, render management impossible, and above all to announce that special protective rules of law will take effect within those limits which do not apply outside them. Consequently, the *gradual* increments on the river side, where in the nature of things there is no human neighbour, would hardly call for any fresh notification. Whenever an increment belongs to any tenure, all the incidents of the principal tenure attach to it (see Indian Law Reports, Calcutta Series, Vol. VII. 479.) The increment is clearly the property of the State, because the principal thing is. If, however, there were to be a permanent and large increase, it *might* be perhaps found best to *notify* it as Forest, because, though the *river* front or boundary would present no difficulty, neighbours on the other side might encroach, or begin to drive cattle to graze, or to cut 'tamarisk' on the new ground, and it would be desirable to declare it unmistakeably *under* the Forest Law; and as no rights could possibly exist, the procedure under Chapter II would be merely *formal*. But here comes the second part of the question. It is perfectly true that any gradual increment, large or small, to a riparian estate belongs to the estate: *but*, the case put by your correspondent, or illustrated by my villages X and Y (above) is different, for though truly X, formerly inland, has now *become*—though perhaps for forty years past—the riparian estate, still, it is known (and I assume *provable* by old maps, records, evidence, &c.) that Y *once* was there; so that the river lapping on X's shore and adding some strips of ground every season, is not merely *the river*: it is *water over Y's submerged village*—the *basis* of which is still in the depth below. Consequently, when land reappears on X's frontier, it is not a mere accretion to X, it is the *reappearance of Y*, and belongs to the owner of Y.

And this rule has been formally laid down by the Privy Council in the leading case of "*Lopez versus Modun-Thakoor*," reported in Moore's Indian Appeals.* It is the leading case

NOTE.—It will also be found reprinted in *Bengal Law Reports*, Vol. V, Privy Council Cases, page 521. Rattigan's (Punjab) Digest of Civil Law. Chap. XIII gives a convenient *résumé* of the Alluvion Law, a great deal of which is not merely Punjab Law, but general, *e.g.*, the rule of right to islands not attached to either shore, and is equally good *everywhere*.

well known to lawyers. There is a similar case in 4 Moore's Ind. Appeals, 403.

In the case put, it is not necessary to discuss whether the doctrine is applicable in India that a man's property goes "down to the centre of the earth," because in some cases it does not, at least in the sense that mineral rights may belong to Government; but apart from that, there is no doubt that the *submersion* of any *known estate* by a river does not alter the ownership. In the case above alluded to, their Lordships said: "The site is the property; and the law knows no difference between a site covered by water and a site covered by crops, provided the ownership of the site be ascertained."

There is, therefore, no warrant for saying that in the case of a *known* or *provable* forest area, disappearing under river flow, and afterwards re-emerging (in proximity to the village estate, once immediately behind it, inland) that "according to existing Rules the forest is gone for ever." No such rule is known to the law. Of course, the Government's right to the Forest area on its reappearing (or any other area) might be *again* lost, under the law of Limitation, by the owner omitting to claim it for twelve years after its reappearance, but that is quite another matter: and in the case of a Government estate, the loss would not occur till *sixty* years had elapsed instead of *twelve*, without any claim to the restored acres.

The *law* is quite clear: but the practice may be different. Take the case of your correspondent's paper. In *principle*, no Court could hold that the Government was not entitled to the new found land: but suppose the *boundary* between the village and the Forest (where both were still unaltered) had never been properly defined or laid down, and there was some doubt about the real total area of the village estate, etc., it might be practically difficult to prove that the new land *was* on the site of the forest. A suit would certainly lie to recover the forest alluded to: it must be successful if the facts can be proved. In short, the rule of accretion may be stated thus:—

When the gradual accretion is really out of the river bed, it forms part of the estate to which it becomes attached, on the principle that the 'accessory follows the principal'; and as regards all rights and incidents of tenure. But when the accretion is not merely out of the river bed, but by way of recovery of a washed away property now slowly coming back again, the new land is (on proofs of the facts) not an accretion to the neighbouring estate, but (as decided in "*Lopez versus Muddun Thakoor*") belongs to the original owner.

B. H. B.-P.

OXFORD, March, 1894.

Utilization of the less valuable Trees.

Having read with much pleasure Sir D. Brandis' most interesting paper on the above subject in the February Number, I think a few words from me on the Madras aspect of the matter may not be out of place.

I am entirely in accord with Sir Dietrich. The importance of the subject impressed itself upon me strongly during the latter part of my service, presenting itself in every case in which protection became a reality. Its solution is by no means easy. It increases the more in difficulty when protection and the consequent growth are easy, complete and satisfactory. Unfavourable conditions of growth naturally reduce the problem to a minimum.

I am also convinced, like Sir Dietrich, that the solution of this and similar forest problems must be devised by Forest Officers themselves; and that they must not wait for orders of Government or any "higher authority," but work them out for themselves, initiating and fostering industries and sources of demand according to local circumstances.

Too much pains cannot, I think, be taken to impress this especially on the younger forest officers, who are naturally inclined to trust to Providence or the natural laws of supply and demand, and await instructions, instead of foreseeing and grappling with such questions themselves.

The influence of a professional journal like the *Forester*, and of such able papers as Sir Dietrich's, by attracting and directing the attention of Forest Officers to the consideration of such matters, ought to be productive of the best results. I should like to see a great many more such papers and suggestions from retired Forest Officers who have experience and leisure. Even if found Utopian or impossible for immediate adoption, such suggestions should lead to reflection and discussion, and might possibly be ultimately productive of beneficial results.

Turning to Sir Dietrich's suggestions for this utilization of the less valuable trees which embrace wood pavement, impregnated sleepers and telegraph poles, paper pulp, acetates, naptha, wood tar, charcoal, and iron; I am afraid that wood, however well impregnated, which must always be more or less a complicated and costly process, is never likely again to take the place of iron in a tropical country for railway sleepers and telegraph poles, and that the manufacture of acetates, naptha and tar is a little beyond the sphere of practical forestry in India at present, though doubtless deserving of attention at the hands of Forest Officers.

There remain charcoal and iron. As to charcoal, a good deal had been done and much remained to be done, when I left the Madras Presidency, in the direction of improving the process and

quality, and rendering larger supplies of a superior article available at reduced prices.

In several instances, the results were excellent, and enabled us to transport and dispose of wood which would otherwise have rotted in the Forest. But it must be borne in mind that the really superior, soft woods produce inferior charcoal—a fact of which our native friends are fully aware—and I am bound to say that good prices were only realised when the charcoal was made from the hard woods or bamboo. Still, as I have said above, a great deal can and should be done in this direction ; and I trust the day has passed in which a District Forest Officer, a German trained one too, with several years' experience, assured me that no charcoal was consumed in his District, a large one, merely because the seignorage returns under that head under the permit system were—*nil* ! (N. B.—This is a fact !)

There is a very large and steady demand for wood charcoal in the Southern Districts, and, I believe, throughout the Madras Presidency ; and the sooner the wasteful, dangerous and, from every point of view, suicidal custom of granting permits to burn it within wide and indefinite areas on a low rate of seignorage is put a stop to and replaced by departmental operations under a proper system and supervision, the better for the forests, the revenue and the consumers.

As regards Iron—I have never been in accord with Sir Dietrich that the failure of the attempt at its manufacture under European process in the South Arcot and Malabar districts was due to scarcity, or high prices, of wood. I stated my reasons for disagreement in a memorandum on his valuable suggestions of 1883.

They were, and are, briefly, that ample supplies of wood of good quality were available, and granted in most cases free of all seignorage or royalty and in others at nominal rates, greatly to the detriment of the forests ; that at Porto Novo and Beypore the cheapest of all carriage, *viz.*, water, was available, whilst at Tiruvanamalai the forest surrounded the town and was intersected by good roads.

I found the cause of failure to be the impossibility of producing iron with wood fuel in quantity and quality to compete with that produced with coal and imported, and quoted my authorities. In the interest of the Department and of the utilization of the less valuable trees, I regret my conclusions, but must reluctantly adhere to them. With regard to the manufacture of iron by the native process, with gradual improvements the case is somewhat different, and I hope it is not too late for efforts in that direction to produce good results. I do not ascribe the decrease in the native iron industry in Madras to actual scarcity of wood or the rates charged for it and charcoal, which have rarely exceeded a seignorage of a few pie per head load if taken for sale, that for agricultural implements, or own use, being nominally at all events free. But there were, doubtless, restrictions and exactions on the part of the Forest subordinates, and we (myself amongst the

number) certainly regarded the iron smelters in past years as enemies and forest depredators, and did our best to suppress instead of encouraging their efforts under regulation. In addition to this, European iron, shaped almost ready for use, found its way into the markets at low prices, and was readily adopted. It was more brittle and less durable than the well-wrought iron produced by the native process, but it was cheaper, and could be procured without so much delay and trouble, at least in the Districts near the coast and on the lines of railway.

In more inland districts, the industry doubtless still survives, and certainly appeared to be flourishing in Bellary when Sir Dietrich visited that District with me in 1882. Whilst, therefore, not so sanguine as he is as to iron-making with charcoal offering "the most promising field for utilizing the surplus wood," I think it most desirable that efforts should be made to revive and foster the old native iron industry with improved appliances and necessary safeguards against waste and destruction of the forest growth.

I am, however, inclined to think that in the supply of wood fuel to the railways, factories, brick kilns, and sugar mills, we shall find a larger and more assured outlet for the less valuable and surplus wood than in the iron and other industries referred to by Sir Dietrich.

It has been customary in Madras for civil officers and others, taking a superficial view of the question, to decry the supply of firewood to the railways, which, it is urged, is denuding the country, for the sake of a temporary revenue, to the detriment of the climate and agriculture.

Under the old system of contractors, who felled as and where they liked, and in the absence of proper protection and regulation, there was doubtless much truth in this view, but with proper departmental action, under which the fellings are regulated and efficient protection subsequently ensured, the objections cease to have weight, and the railways burning wood should become the best friends of the forests and agriculturists, enabling us to conserve large areas for the growth of timber, whilst disposing of the small and inferior descriptions as firewood at prices which will more than cover the cost of conservancy and improvement. It cannot be too frequently repeated and borne in mind that, whilst the denudation of forest areas, however extensive, is, *in the absence of protection*, a mere question of time, comparatively small areas, *properly treated and protected*, will last and give a sustained and increasing field *for ever*. Every Forest Officer is, of course, conversant with this; but we do not always apply it practically, and are apt to grasp at the partial control of large areas instead of restricting and concentrating our attention on such as, with the means at our command, we can really protect and improve.

I well remember Sir Dietrich (then Mr.) Brandis impressing this on me in England years ago with regard to this Salem District,

and urging that reform and progress in Forest management in Madras, which was at the time languishing, must be brought about by individual efforts of Forest Officers who understood their profession producing examples of its application on however limited a scale.

I am afraid I did not take his advice so much to heart as I ought, but its truth was brought home to me when a young District Forest Officer, Mr. Porter, concentrated his attention for a time on what is known as the little Sholakarai Reserve in South Coimbatore, and in a short space of time transformed what had been a constant source of expenditure without any good results, into one of permanent income together with an improvement in the growth sufficient to convince the most sceptical of the advantages of rigid protection from fire and grazing and of properly regulated fellings.

Mr. Brasier in Tinnevely and Mr. Marshall in North Arcot followed suit, and I am glad to see from extracts from Inspection Reports by Mr. Popert in the February number, that the former officer is initiating similar reforms in Salem.

This brings me to Sir Dietrich's remarks on the measure of protection afforded in that and other Districts of the Madras Presidency since his visit, and the passing of the Forest Act.

I regret to have to confirm the conclusions at which he has arrived from a perusal of the Annual Reports, that protection has been most inadequate and disappointing, and *therefore* we do not find the bulk, or indeed any given proportion of the so-called Reserved Forests, forming "dense compact masses of forest growth" as they ought to have done, and certainly would have done in greater or less degree had complete protection been secured and maintained even over comparatively small areas during the past ten years. My last inspections three years ago convinced me that in most of the Southern Districts at least, there was virtually no protection at all; and in Salem and South Arcot the protection was even less than was the case 10 or 20 years before when the enclosed areas then styled "Fuel Reserves" were at least partially protected.

This lamentable state of things was doubtless partially due to the time of the District and Range Officers being much occupied with Forest settlement and demarcation, which have presented many more difficulties and delays than originally contemplated, to the paucity of protective establishments, to changes of District Forest Officers and Collectors, to divergences of opinion, to a vacillating policy on the part of the Board of Revenue (the "Controlling Authority") and of Government; and last, but by no means least, to want of knowledge and zeal, and loss of interest in their work on the part of some, at least, of the District and Range Officers, and to the absence of one professional Head of Department with power to prescribe and enforce continuity of action, encourage the willing, and spur the lazy or supine.

I do not wish to trench on controversial topics connected with the organization and administration of the Department in Madras. Suffice it that, in my humble opinion, there are too many masters, too much centralization in a non-professional Board, and too much non-professional interference all round which irritates and disgusts a sensitive and zealous Forest officer who knows how things should be managed, and affords a screen to the thick-skinned, lazy and ignorant who are fortunately in the minority, in the controlling grades, at all events.

I trust things have mended, and may continue to mend, although my recent advices from Madras are not encouraging.

Anyhow, I would *strongly commend Sir Dietrich's advice and hints* to Forest officers in Madras and elsewhere.

Reading between the lines they amount to much the same as he gave me years ago. Stick to your professional work, protect and improve 100 acres if you are not allowed to close 1,000, don't write or argue, accept and obey orders cheerfully, but *with discretion* (!); trusting to the whirligig of time to bring things straight and the results of your work to speak for themselves, and prove your best reward, and never cease in your endeavours to secure and maintain the highest possible yield of the description of forest produce you wish or are ordered to grow, and to ascertain and develop the best markets for it.

If our District and Range Officers adhere to something like the above principles, and the Conservators support and encourage them, and do their best to secure continuity of action and a steady policy on the part of the Board of Revenue and the Government, I do not despair of the adequate protection of sufficient areas being secured, even under the present somewhat complex system of administration in Madras, to an extent which will render the question of the utilization of the less valuable trees urgent. More especially am I convinced that protection alone will not suffice to regenerate the "jungles" in which the trees have been hacked about and browsed over, but that it must be accompanied by "improvement fellings" varying in accordance with circumstances, but all yielding considerable quantities of wood chiefly inferior both as regards description and growth, on the profitable utilization or disposal of which progress will, from financial reasons, greatly depend.

It may not be out of place to state, in conclusion, that the yield of the Blue gum plantations on the Nilgiris has, as Mr. Gamble is aware, exceeded Sir Dietrich's estimates, being nearer 10 tons per acre per annum than 6, but they have not been extended, as there is not sufficient demand even for the annual *coupes*, owing to the existence of extensive private plantations of the same tree. The Nilgiri railway must now be approaching completion, but I do not anticipate much increase in demand from it, either as a consumer or carrier, the rapid growth and large proportion of water in the

Eucalyptus wood rendering it unsuitable for engine fuel, and the cost of carriage to the plains by rail being, I fear, prohibitive.

The yield from the Casuarina plantations in the plains has also proved fully up to Sir Dietrich's estimates, but they have sustained much damage from irrational treatment in order to secure an immediate revenue, storms, and exceptionally dry seasons.

In the case of the Casuarina, the demand is secured, but private enterprise has rendered it almost, if not altogether, unnecessary for Government to extend its planting operations. On the whole, I am of opinion that the efforts of the Department are best directed to the conservancy and improvement of the natural forests and "jungles" in order to produce and secure a sustained yield of timber and firewood sufficient not only for present but for future requirements, as well as adequate supplies of grazing fodder and thatching grass, leaves for manure, and other minor produce.

Notwithstanding this somewhat lengthy paper, I feel that I have by no means exhausted the subject, but if my writing leads to consideration and discussion, it will, I think, not be wasted.

NAVAL AND MILITARY CLUB, } I. CAMPBELL-WALKER.
 30th March 1894. }

Damage done to Himalayan pines by Loranthaceous parasites.

During his travels in Kashmir in the last few years, Mr. J. F. Duthie, Director of the Botanical Department, Northern India, found again a minute parasitic plant, which he had originally discovered in Kumaon in 1884, and which Mr. J. L. Iace afterwards collected in Kunawar. This plant, the *Arceuthobium minutissimum*, was growing on the stems of the Blue Pine (*Pinus excelsa*), and doing them considerable damage. It is probably the smallest flowering plant known, and has the appearance on the bark rather of a moss than of the plants of the family to which it belongs, that of the *Loranthaceæ*, of which the mistletoe is the best known member. Recent enquiries made in the Forest Department by the Inspector-General of Forests brought out the opinions that the mistletoes were certainly uncommon plants on the Himalayan pines, but it is probable that the writers did not quite sufficiently realize that it was the minute *Arceuthobium* that had led to the enquiries and not the comparatively large species of *Viscum* and *Loranthus*. We recommend such of our readers as have the opportunity, to look for the *Arceuthobium* on Blue Pine trees, and ascertain in what the damage it does consists. Those, too, who have the opportunity, whether in the hills or in the plains, should investigate the common species of *Loranthus* and *Viscum*, for it is undoubted that they do considerable damage in some places, and enquiry might lead to means of protection.

Albizzia Lophantha as a 'reboisement' plant.

We have received enquiries, asking us, for the information of Baron von Mueller of Melbourne, what it is that is being done with the large quantities of seed of *Albizzia lophantha*, which have been collected every year in Australia and sent to the Punjab for Forest Department purposes. All we have been able to ascertain is that it has been tried in the re-stocking of barren hill sides at 2,000 to 3,000 feet elevation in the Jhelum Salt Range and the Pabbi Hills, where the summer and winter extremes of vegetation may be taken as 170° in the sun and 115° in the shade on the one hand, and 32° and 40° on the other. What has been the result is what Baron von Mueller wishes to know ; and we confess also to some curiosity ourselves. Will some Forest Officer in the Punjab kindly tell us all about it—how the plantations were made, whether by direct sowings or by nursery transplants—what has been the result—why was the *Albizzia lophantha* (which by the way is not a timber tree at all) chosen—and what are its peculiarities which render it useful as a 'reboisement' plant ?

We have seen the plant frequently in the Nilgiris, where it is not uncommon in the undergrowth in Aramby, Tudor Hall, the Government Gardens and elsewhere : it was a straggling, soft-wooded, wattle-like plant with pretty spikes of pale yellow flowers, but it did not seem to be particularly noticeable as likely to thrive in such a climate as that above described.

Notes on Forest Tram lines and Wire tramway in
Germany and Switzerland,
by H L. Porter.

Hohwald Railways, Vosges.—In the vicinity of the Hohwald there are three forest railways, *viz.*, one at Welshbruch, one at St. Blaise, and the third at Schorinech. The latter was not visited, as it is similar to the one at St. Blaise. These railways are exceedingly interesting, as the question of forest railways is at present attracting much attention in India, and especially in the Madras Presidency, where more progress has been made than in other parts of India.

The Welshbruch Railway was constructed by the town of Ban, and four other communes, and runs through thick forests. Its length is 11,000 metres (about 7 miles), gauge 1 metre, weight of rails per metre 12 kilogrammes (about 26 lbs.) minimum radius of curves 25 metres, maximum gradient 7·6 per cent., mean gradient 5 per cent. From the forest to the terminus outside, there is a down gradient the whole way. The empty trucks are pulled up by horses, the loaded trucks run down of themselves, and require a brakesman for each truck. The peculiarity about this line is that the wheels are provided with a double flange to prevent derailments; this is a very clumsy arrangement. The line is said to pay 10 per cent. on the capital outlay. Personally, I do not see how such a line can pay. The principal expense in timber transport is the cost of loading and unloading. When once a cart or truck is loaded it does not cost more to move a log three miles than it does two. The terminus just outside the forest is about two miles from the Ban Railway station. Did the tramway run to the railway station, nothing could be said against it, but no figures will convince me that loading timber on the forest railway trucks one mile from the terminus, unloading at the terminus, reloading in carts and then carting to the railway costs less than carting the whole way. The profits must be more than swallowed up by the two miles of road from the terminus to Ban. To extend the forest railway to Ban, it would be necessary to take up vineyard land, and this would be too costly.

The second tramway inspected was at St. Blaise a few miles from Rothan. Its length is about $13\frac{1}{2}$ kilometres ($8\frac{1}{2}$ miles), gauge 70 centimetres (2 feet 4 inches), weight of rails 16 kilogrammes (35 lbs.) per metre, maximum gradient 7·6 per cent., mean gradient 5 per cent., total cost 100,000 marks (£5,000), and this includes an engine of 50 horse-power and 30 trucks (15 doubles). The minimum radius of the curves is 20 metres. This railway was constructed to work a block of forest of 70 hectares, in which all the trees (silver fir) had been blown down during a gale. It was necessary therefore to remove them at once, otherwise they would have become valueless, had they had been left out in the open for any length of time. This line almost throughout its entire length runs along the side of the main road, and crosses it in several places, for it is not uncommon in Elsass and also in Switzerland for railways to run along the road. This saves the cost of taking up land, and no one seems to consider it a dangerous practice. The line has only recently been laid by Forstmeister Bieran, who has taken up forest railways as a study, and has been relieved of his ordinary duties. The work throughout is excellent, and there have been no accidents in spite of the sharp curves and steep gradients. Steam is the motive power. Each truck is provided with a powerful brake, invented by M. Bieran, who promised to send me the plans, but up to date has not done so. The

terminus of this forest railway is the St. Blaise railway station. This block of 70 hectares contains 20,000 cubic metres of timber, and it is estimated that by using the railway over $2\frac{1}{2}$ marks per cubic metre will be saved. Not far from Rothan is the Schorinech forest railway similar in almost every respect to the one at St. Blaise.

Forest railway, Zurich.—The forest railways used in the Schwald forests near Zurich are less modern than those in Elsass. The gauge is two feet, the rails which are of all sorts and kinds appear to be about 14lb. to the yard, the trucks and brake arrangements are decidedly primitive, and the permanent way roughly laid down. A railway of this description costs little, as most of the material was purchased second-hand; it doubtless serves the purpose for which it was constructed, *viz.*, for carrying fuel and small pieces of wood, but it would not do for heavy timber. The Schwald forests belong to the town of Zurich, and M. Meisli, the Forest officer in charge, has to turn everything to account to make revenue: he has established workshops just outside the forest, close to the Schwald railway station; here poles are impregnated with sulphate of copper, and billets converted into axe handles, wood wool, and small bundles of firewood. Apart from the question of interfering with trade, and in spite of figures to the contrary, I feel convinced that it would pay better to sell the wood in the rough. Figures are very misleading as they can be made to prove anything.

In the Hohwald forests of Elsass, and elsewhere in Germany and Switzerland, sledges are much used on the hills for bringing down timber and fuel. The best gradient for the sledge roads, so the workmen informed me, was 7 to 8 per cent., it should never exceed 12 per cent., as the sledges become unmanageable. It is surprising what heavy loads can be brought down. I saw sledges piled up to a height of ten feet with billets, and containing from $2\frac{1}{2}$ to 3 cubic metres being brought down by one man. Accidents do occur occasionally through the sledges becoming unmanageable, but this is not often the case.

In the vicinity of Bellinzona in Switzerland (on the St. Gothard railway) wire cables are largely used for bringing down fuel and small timber from the mountains. Regarding the cost, &c., of these, it is most difficult to obtain information, as they are without exception the property of the merchants, who purchase the wood standing from the communes and private owners; there are no Government forests in the neighbourhood. I inspected several cables, which were being worked. Of these the most modern and consequently the most perfect, was one at Arnedo, about half an hour's walk from Bellinzona. The total height is 2,850 metres, cost 10,000 francs (of this sum 1,800 was spent in putting it up), average gradient 28 to 30 per cent., number of supports 11, area of forest purchased 1,500 hectares, time allowed for removal 5 years, estimated amount of produce 15,000,000

kilogrammes, amount paid for the block 35,000 francs. The above information was supplied to me by the merchant who owned the cable. The circumference of the cable, which carried the produce was two inches, and that of the brake wire $1\frac{1}{4}$ inches. The altitude at the top, as measured with a pocket aneroid, was 4,075 feet and at the bottom 1,900 feet. The system is almost identical with that described by Colonel Campbell-Walker, as existing in former years near Lucerne. It consists of two parallel stationary cables to carry the produce, and of a continuous moveable cable running round a drum at the top and at the bottom; this latter is fixed to the loads and controls them, being itself controlled by powerful brakes acting on the drums at either end. By this means the loads can be stopped at will, and it not only controls the loads coming down, but also pulls back the wheels and hooks, which bring down the produce. The loads are brought to the top station, by means of radiating auxiliary cables, leading from different parts of the block; these auxiliary cables are simple wires, and are worked without any brake arrangement; the loads rush down them at a terrific pace, and are brought up against a thick bank of earth. At Roveredo, some distance from Bellinzona, another cable was inspected; this unfortunately was not being worked.

Timber slides or slips with a semicircular section made of round poles nailed together and wooden troughs made of planks, were inspected at Schwald, the former are used for bringing down poles, and the latter (gradient sometimes 1 in 1) for billets.

The conclusion arrived at by me with regard to forest railways on the continent is that they do pay under certain circumstances; the conditions which obtain at St. Blaise are distinctly favorable, here we have the case of a fully-stocked forest containing only ripe trees; these have all been blown down by the wind, and in order to realize anything, they must be removed at once, it would be impossible to do this with carts, as sufficient carts were not available. In our Madras forests, with few exceptions (in plantations and perhaps on the Anaimalais) forest railways will not pay, as the forests are so poorly stocked. If a railway for the removal of timber is required, the rails should be fairly heavy and certainly not less than 25 or 30 lbs. Toy tramways with rails of 14 lbs. and under should not be used, this has been found out by experience on the Anaimalais. Another important point is that the line should be well laid and ballasted. Wooden sleepers are the best to use; and it is a mistake to suppose that light rails (*e.g.*, 14 lbs.) laid down anyhow will serve the purpose, they won't, and constant derailments will be the result, not to mention the bending and contorting of the rails. Good brakes on *each* truck are a necessity; those invented by M. Bieran cannot be improved upon; the side lever brakes supplied by Messrs. Fowler and Co. are not sufficiently powerful; further they are continually getting out of order, and the levers bend or break; the special brake vans supplied for the

Anaimalai tramway were a complete failure. In any case, special brake vans are a mistake, as they are quite unnecessary, and an extra expense has to be incurred in moving them about the line. The minimum radius of curves should not be less than 20 yards, and the rails should be bent as required; it is a great mistake to get set curves from the makers; they are too sharp; a single truck may get round them without derailing, but double trucks will not, unless a third or guard rail be used.

Wire cables can be used for crossing deep valleys and for bringing forest produce down steep hill sides; this would of course be allowable under *certain circumstances*, but in the neighbourhood of Bellinzona the hills are becoming rapidly denuded, as it would not pay to put up a cable to a block of forest, unless it was to be practically clean felled. Avalanches and torrents are the result, the Swiss Government looks on while the hills are being denuded and their attempts to repair the damage done by re-afforesting practically at its own expense; as the owners, so the forest-officers informed me, often refused to re-afforest when the Government offered to bear as much as 90 per cent. of the cost; in this free country it is apparently impossible to acquire such lands as being required for a public purpose. These precipitous hills, which are becoming rapidly denuded, remind one of many hills in the Madras Presidency where the denudation is due to the same causes by overworking and cattle-grazing. As a general rule, it is advisable to leave alone forests growing on hill sides, which are too precipitous for roads, the revenue to be derived is small in comparison with the irreparable damage done; far better to treat them as forests of protection, and exclude religiously cattle and cutting instruments. If large quantities of heavy timber have to be brought down steep hill slides from plateau or tablelands, a railway with a self-acting incline is preferable in every way to wire cables or slides. For removing trees to the road, there is nothing better than the Indian elephants; I saw several kinds of screw jacks and levers in use, but the process was slow and costly. Sledge roads could, I consider, be used advantageously in many of our Madras forests.—
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Vallombrosa and the Royal Italian Forest School.

On the Eastern banks of the Arno, a mile from the city gates, rises a small hill, on whose crest are to be found the ancient remains of Fiesoleum, a name not unknown to the student of Roman History, and interesting as having formed the first beginnings of the present city of Florence.

The slopes of the Hill of Fiesole are studded with picturesque villas, (everyone has lately heard of Villa Palmieri and Villa Fabbricotti, Queen Victoria's temporary abodes), from which enchanting views of the Arno valley are to be obtained ; but nothing can equal the view from the summit of the hill itself. Florence, spread along the banks of the silvery Arno, brings to one's mind thoughts of some ancient walled citadel, though in this case encompassed by a wall of mountains, the blue Apennines. On the north these rise to a great height, culminating in Monte Morello, a prominent eminence, on which the eye must often rest, if only on account of the saying that when Monte Morello is capped with clouds, the wise Florentine should not forget his umbrella.

Towards the close of autumn, as the usually bright and sunny Florentine winter sets in, from Fiesole's breezy outlook, facing to the south, may often be seen in the far distance on a rising point of the Apennines, a patch of white snow, rendered the more conspicuous by the black ground on which it appears to lay. That is Vallombrosa, the valley of shade, the abode of the Royal Italian Forest School, a place unrivalled for the beauty of its scenery and of its woods, and to which we now propose to proceed.

Leaving Florence by the Rome express, the so-called 'lightning train,' (*treno lampo*), at 7-30 A. M., the passenger alights at the

little station of St. Ellero at 9 A.M. Here a small mountain train is in readiness to take him to the heights above. The railway line is constructed on the rack system, *à cromallière*, as it is termed by the patentee, Count Telfener, the constructor of this railway. The line, which is 8 kilometres in length from St. Ellero to Saltino, rises very abruptly, and in places the slope reaches an inclination of 22 per cent. The wagons, which are 11 metres in length, and 2·30 metres broad, are capable of seating 56 passengers, the train being generally made up of 2 carriages, which are pushed forward by an engine attached behind. By the time the first station, Donnini, is reached, distant 3 kilometres from St. Ellero, the train has already risen 326 metres above sea level. At Filiberti, the second station, about $1\frac{1}{2}$ kilometres from Donnini, the height reached is 418 metres. From this place the slope increases, and after rising for a distance of about 3 more kilometres, the terminus, situated on the small plateau level of Saltino, which is 1,000 metres, is reached.

The Railway itself is said to be of the safest, both in the system adopted, the *cromallière*, and in construction; and the line is carefully guarded by "Choukidars" placed at close and regular intervals. Still the traveller may well feel ill at ease, and feel that he is tempting Providence when crossing some of the grander passes where space, and space alone, appears to intervene between him and the abyss below. But the traveller in these parts may trust himself with confidence to the Providence, which if the local legends be credited, has often intervened in a miraculous manner to preserve the unwary pilgrim. Close to Saltino itself, near the Paradisino, is to be found a rock bearing the impression of "Saint" Giovanni Gualberto. History relates that "Shaitán" one day to please a wicked whim wished to push the saint into a torrent, but the man of God leant against a stone, which lay close by, and the stone at once becoming soft as wax, enabled it to receive his body and hold it back from the abyss. But, on the other hand, the wicked may well shudder; for at one of the worst points is not the so-called "Masso del Diavolo" pointed out to this day? So-called, because when the monastery at Vallombrosa was first started, a novice fled, wishing to return to the world; but no sooner had he removed his monk's attire than the Demon appeared and threw him into the horrible chasm below. A long and beautiful inscription bears faithful record of this occurrence. At any rate on our journey, we may well hope that if an accident does occur, all the rocks will doubtlessly turn to wax.

Many are the writers who have described the beauties of this valley; but for a description of the journey, the ride from St. Ellero to Saltino, the words of a well-known Italian writer, Raffaele de Cesare, may well be quoted:—

"Along the winding road, which leads from Pontasieve to Vallombrosa, each turn lends enchantment to the view, but when

the road enters the forests, leaving the 'zone' of the vine and the olive below, it seems to lead one into a Gothic temple, stretching to infinity. The towering pines almost entirely shut out the skies, and the road, bordered by closely-packed chestnut trees loses itself in the dark uncertain light. The forest has all the appearance of a park; the usual thickets and forest plants are wanting; the ground, in many places, is even grassless. In the denser parts of the wood, no air, no light for undergrowth. Right up to the monastery one marvel of scenery follows another, the more enjoyed in so refreshing and cool an atmosphere."

At Saltino, the terminus of the Rack Railway, a fine Hotel of magnificent proportions has been erected, where every comfort of modern times may be obtained: and above all, from the terrace running along the Northern face of the Hotel the view is stupendous. At one's feet lies the whole valley of the Arno, every inch to be clearly discerned, each hamlet, each castle, each house may be made out; in fact, the whole of the fertile plain of Cascia, with its hamlets of Incisa, Rignano, Figlino, San Giovanni, Montevarchi and Pontassieve. Lounging on the terrace on a summer's eve, smoking a cheroot, the sunset is a sight not easily forgotten.

In connection with Saltino* and the origin of its name a sad tale is related. A certain man wearied of the cares of life, having wended his way to this spot, his last paradise, took a *little jump* into the precipice below. If it is indeed true that this legend has given its name to the place, it is certainly equally true that it has not imparted to it any of its melancholy sadness.

From the Hotel at Saltino a short stroll leads one by a good road, the same along which we may imagine *San Giovanni Gualberto* himself first came, though the original path has lately been enlarged, planted with shady trees, to Vallombrosa, the site of the old monastery, the present Royal Italian Forest School.

Nine centuries ago young Giovanni Gualberto, a knight-errant, came to this spot. Wearied and foot-sore he sat him down under the pleasant shade of a beech tree, which let down its leafy boughs to surround him and protect him from all danger.

At the same time a pure crystal stream of water sprung from the roots of the tree. The Faggio Santo, the sacred beech, is still pointed out. Apparently Gualberto, either to perpetuate his gratitude for this act of grace, or taking this occurrence as a sign of heaven, set about founding an order of monks, known as Vallombrosani, who, settling down at Vallombrosa, built a monastery and rapidly increased in reputation, honour and riches.

*Saltino=small jump (salto.)

The monastery is an enormous solidly built palace, with 3 towers, without any pretensions to architectural beauty of design, though stately in its severe outlines. There are spacious court-yards, vast porticoes, a verandah, some 50 metres in length, leading into the cells, which were to all appearance roomy and gay. The church is large and airy, but has nothing noteworthy with the exception of a number of relics, among which may be mentioned the arm of Saint Giovanni Gualberto, the founder of the order. There is in fact nothing worthy of notice unless, taking an interest in culinary matters, we enter the kitchen. Here is to be found a fireplace, which is situated in the centre of the kitchen, and reminds one of some ancient Hindu temple, for it consists of a beautifully designed "cupola," supported by 4 massive columns. At first sight it is only possible to imagine that the dome must have protected some heathen shrine; but the mind quickly turning to more worldly thoughts conjures up visions of the numberless lambs, and pigs, and wild boars, and even calves that hung up whole, must have slowly been brought to the right degree of crispness, while the happy and fat Vallombrosani monks, clothed in their loose flowing robes, sat on the platform around that central fire warming themselves, and licking their chops. O tempora! And if such was indeed the case, the monks tearing themselves from that enchanting spot, must have been somewhat rudely brought back to a sense of their position by reading over the door of the refectory the motto which still exists;—"L'Amor di Dio non consiste nel mangiare e nel bere,"—(the love of God does not consist in eating and drinking)—a saying which the monks evidently forgot in the year 1866, though perhaps not for the first time, when the decree of suppression was about to be issued. On that occasion, after selling all the lands they could, and collecting their wealth, they divided equally amongst themselves and went their way. Still it is always a consolation to think that if the church and Convent are no longer what they were, the good works of the monks remain after them; the forests remain, which defy all time.

The territory of Vallombrosa, which formerly belonged to the "Monaci Benedettini della congregazione Vallombrosana," as already stated, is to-day the property of the *Domaino dello Stato*, thus assuring the permanent retention of the vast forests to the State, and has utilized the old and roomy convent buildings for the housing of the Italian Forest School. There are about 50 students in the College, who after completing a special Course of study extending over 4 years, are appointed Assistant Sub-Inspectors of Forest. (Sotto—Ispettori Forestali Aggiunti). The School, which gives an excellent forest education, is under the directorship of Comm. Ing. F. Piccioli, who is doubtless well-known to all students of Continental Forestry for the number of excellent text books he has written on forest matters. He also edited for some time at considerable personal expense and cost, a *Forest Magazine*, which

has lately been abandoned for want of support. The assistant professors are Cav. P. Nico for Mathematics ; Sig. R. Sulla for Botany ; Cav. V. Perona for Sylviculture ; Sig. Gatti Menotti Garibaldi for foreign languages, and a few others.

The lovely woods of Vallombrosa are situated on the Northern slopes of the Tuscan Apennines, and reach a height of 1,446 metres. The forest vegetation of Vallombrosa is said to be amongst the richest of Tuscany for the number and varieties of its plants, and indeed may this seem possible after a perusal of a very interesting little work, a botanical guide book to Vallombrosa, published by Lodovico Piccioli in 1888. (*Guida alle escursione botaniche nei dintorni di Vallombrosa*).

Many generations of men, dedicating themselves to a life of ascetism, taking under their special care the protection of souls *and of trees*, for eight centuries, used every endeavour to clothe those heights with a pleasant verdure. Bleak and desolate spots under their patient care were converted into magnificent and stately forests.

It is now over 9 centuries, as already described, since San Giovanni Gualberto first took up his abode on these heights and founded the order of Vallombrosani. Soon after its foundation many people came forward to endow the monastery with lands, chief among the donors being Corrado il Salico, a devout prince, and Ghiocella, a pious court lady ; and, in the hands of the monks these lands assumed new features. It is to the monks that the transformation of those lands from mere barren wildernesses into pleasant hills, thickly clothed with forests, is due ; and one can only feel grateful to them, the more so on account of their being no longer there to reap the fruit of their labour. The students of the Forest School have taken their place, and the woods are the property of the State.

Down below, close to the bridge of Tosi, commence the chestnut woods, which, occupying the lower level, stretch far away into the Milosa plain, yielding large and luscious sweet chestnuts of excellent flavour. As the road rises, however, and Fossacormoti is reached a change in the atmosphere is already felt, and the imposing pine forests are entered ; and what at once strikes the eye *are* the wonderfully regular lines in which the pine trees, with almost truly mathematical precision, are planted. They have been described as having the appearance of a huge army drawn up in regular, open battle array. Rising still further to some open spot, the next thing which strikes the eye is the ease with which the different age classes may be distinguished, forming as they do a pleasing study in greens, a dark green for the patriarchs, a lighter green for the young men, and a very light pale green distinguishes the youngest. In these forests, which are treated on a selection system (*jardinage*) with rotation of

100 years, the darkest-green is the prevailing colour, for the old trees are still in the majority, and it is these older trees rising like mighty giants that lend majesty to the scene. The sight is indeed most varied, and it is impossible in a description to do full justice to a scene, which filled Milton, Ariosto, and many others with enthusiasm. Thus Ariosto describes the scene :—

“ Cantan frai i rami gli angelletti vaghi,
Azzurrie e bianchi, e verdi, e rossi, e gialli.
Murmuranti ruscelli e cheti laghi,
Di limpidezza vicono i cristalli :
Una dolce aura che ti par che vaghi,
A un nodo sempre, e dal suo stile non falli.
Facea sì l'aria tremolar d'intorno.
Che non potea noiar calor del giorno.....”

And, in the pinewoods many are the shady spots, pictures which remind one of Doré's illustrations to Dante's *Inferno*, veritable abodes of nymphs and goblins—one's idea of the Walhalla of Scandinavian mythology. One particular wood, planted at the commencement of the century close to the Monastery, on the steep, precipitous slopes of a hill, where the clear pine boles, so carefully aligned at such regular intervals that they appear to form so many columns supporting the leafy dome above, cannot differ very materially from that which gave Milton some of the most sublime inspirations to *Paradise Lost*.

Many who will remember the correspondence which appeared in the *Pioneer* a few years ago regarding the acts of vandalism the Indian Forest Department were supposed to be perpetrating by felling some of the old and picturesque trees in the Dún, may appreciate the following extract from an Italian paper the *Corriére di Napoli* :—

“ Neither the Alps nor the Pyrenees can offer so stupendous a sight, and, perhaps it is, alas, more than certain that Vallombrosa itself will be able to offer it no longer when with the lapse of time, the beautiful century-old trees of the woods planted by the monks will have been replaced by the less regular plantations, made with less patience, of the Forest School.”

Unfortunately those who have visited the magnificent and picturesque, “scientifically” formed German forests cannot feel any alarm or be moved by such writings.

In addition to the chestnut and pine forests, far away on the Eastern limit of the Pine, the zone of the beech is entered, forming many interesting woods.

The whole of the Government estate is easily accessible, the Forest School having constructed good, shady and wide roads, and paths leading to the more inaccessible and steeper points. Needless to say that the number of walks and excursions from the Hotel is endless : a climb to admire the sunrise at Secchietta, the

highest point, 1,500 metres above sea-level from which the most extensive panorama may be enjoyed, as it were touching Florence with the one hand and Siena with the other, the whole of Etruria at one's feet; a stroll through the woods to the "Lago," the Eastern limit of the State forests, and to the "Bocca del Lupo" the western limit; then, further away and outside the limits of the State domain to Camaldoli and l'Alvernia, into the Mugello and the Casentino, to the castles of Vincigliata and of S. Mezzana di Panciatichi; and many more, too numerous to relate.

For the shikari again, Vallombrosa has its charms. Partridges, quails, hares, wood-pigeons, doves, used to abound, as well as squirrels, though a shooting permit from the Minister of Agriculture is necessary, except in the case of squirrels. The slaughter of these animals is actually encouraged. They cause much damage to the pine trees, and consequently a reward of 20 centimes per squirrel-tail may be obtained from the Department of Agriculture, a practice which also exists in many Scottish forests. Bears, it is to be feared, have quite disappeared, though these appear to have existed in past ages. On the walls of the Monastery, where many of the miracles performed by the San Giovanni, the founder, are inscribed may be read the following:—"Il Santo ordina me converso di andare ad ammazzare un orso in una grotta e il converso va e l'orso esce dalla grotta per farsi ammazzare." Perhaps modern bears, even if they existed at Vallombrosa, would not be so amenable to reason.

In the Monastery itself a bright new visitor's book is still kept, and though all the scribblings bear witness to the charms of the place, it is necessary to turn to the pages of a more ancient and long disused volume to find anything worth transcribing. A French visitor, breaking into poetry, thus addresses his invocation to Vallombrosa:—

" De ces monts surcilleux qu' habitent les orages,
Que l'étranger visite ainsi que les nuages,
Qu'il est doux de prier avec un doux amour,
De rever au bonheur de l'éternel séjour.
D'ici je crois ouïr des paroles étranges :
Est-ce la voix des Saints, ou les concerts des Anges ?
Ici je comprends mieux du ciel l'immensité,
Et voudrais ni élaucer vers l'immortalité."

Whilst yet another Frenchman wrote:—

" L'oubli, le calme de l'esprit, la paix du cœur sont possibles dans une semblable retraite. Les grands spectacles de la nature doivent contribuer à rendre l'homme meilleur. Demeure délicieuse de Vallombreuse, Adieu ! Séjour des anges, où y domine le beau et le sublime, où jouissant de la vraie beauté de la nature on s'approche à son Dieu : Adieu ! "

A. C.

The Herikalgudda Forest. By N. Narayen Rao, Forest Ranger, Hassan.

This hill forest is situated in the Arsikere taluq of the Hassan District, Mysore. It derives its name from Herikal, a huge rock, measuring 40 feet in height by 360 feet in girth. The group of hills measures about 58,800 acres, or 92 square miles in extent, and possesses a varied flora. The highest peak is Kare-kulloo, 4,300 feet above sea level. The circumference of the base of the hill is $21\frac{1}{4}$ miles, and a cleared line, 22 yards wide, separates it from private holdings and other district or unreserved forests. On one of these hills is situated a temple of Sri Venketramananaswamy, a shrine of great antiquity. It is known as Malekal Tirupathi. A flight of 1,750 steps leads to the top, and the ascent of these steps is supposed to be an efficacious substitute for a pilgrimage to the famous Tirupathi shrine in North-Arcot. A Rathotchavam or car festival is held at Tirupathi at the foot of the hill in Ashada, in July each year, and about 3,000 to 4,000 people attend.

There are some temples, partly in ruins, and other monuments which indicate the existence of a city on the Herikal hills in former times ; and it is understood that during his wars with the Mahrattas Hyder Ali removed his people to form a city at Nagpuri on the Herikal hills. The circumference of the plain on the hill is $11\frac{1}{4}$ miles.

The hills are of primitive formation, chiefly granite, and this is abundant, and is fit to be quarried for building purposes by the simple application of heat. The entire group is composed of several rocks or rugged hills, each of which has a name given to it, which is taken from some romantic incident of its own. There are 65 hillocks of the kind.

Around the hill are several villages, more or less thickly populated ; and each village has a pass of its own to go up the hill and join the common Nagpuri-Bylu (plain), wherein is situated the Sri Shankeriswara's temple, the common god of all persons of the Shivaite sect, residing in the villages round the hill. All these passes are ascended by very steep paths, only practicable for pedestrians.

It was years before this hill forest could be brought under reservation and the management of the Forest Department. The question of reserving it was first mooted about the year 1872, when Colonel Hill was Deputy Commissioner of Hassan, and after much opposition on the part of the ryots and trouble in the acquisition of two private rights in the forest, it was finally reserved in the year 1882 after a period of 10 years had elapsed in a struggle with a heavy file of correspondence. The difficulty lay, as usual, in the fact of the ryots not appreciating the value of the conservancy of the forests.

It is very probable that the hill may have been well wooded during the time of the poligars, as on many of the hills traces are to be seen of forests cut down long ago, and this statement is confirmed by the existence of fine trees in inaccessible places, and of kinds of trees which are not generally cut by ryots for timber, &c. Between the time of the poligars and that of the conservation of the forest by the State, cultivators appear to have cut down whatever they required for agricultural implements, &c., regardless of the destruction caused to young trees and saplings. No one ever thought of planting new trees to replace those that had been felled, and so, as population increased and agriculture spread, the remaining trees rapidly disappeared. The denudation of trees from which the taluq suffers has probably much to do with the prevailing drought, there being scarcely any vegetation to arrest the passage of the monsoon clouds which float onwards without depositing their valuable contents.

Since the Forest has been taken under the management of the Forest Department, and particularly during the more recent years, much has been done to improve its condition, notwithstanding its defective situation. All possible efforts to encourage natural reproduction are being made. Roads have been to some extent cut through the forest, and at intervals spacious alleys have been made to serve as a means for arresting the march of destructive fires. A fire in this hill forest means terrible damage done to the standing stock, the advance growth, and the destruction of all fallen seed, the germ of future plants. Now the whole forest is divided into 8 parts, with cleared lines of 10 yards wide running from north to south, east to west, north-east to south-west, north-west to south-east, measuring in all 38 miles in length, thus giving scope for the easy arrest of fire, with the help of but a few men.

Fire in this forest is not generally the result of any natural causes. It is generally understood to occur from cattle tenders, who at their midday halts either to secure early and better growth of grass or for no reason whatever set a light to some dry grass, which in its turn communicates the flames to the underwood, and passing on through the long and tufted grass, in a little while the whole forest itself, covering each hill, forms an immense conflagration. Such sad occurrences are now put a stop to.

Though this hill forest cannot be compared with any of the evergreen forests in the west, and is but a scrub deciduous forest, it is important on account of its situation in an arid taluq like Arsikere, and its close proximity to the Railway. Trees of average growth and sufficiently large for ordinary house-building purposes are to be found in all low-lying places. The shrubby kinds are invaluable for fuel. The dominant species is bamboo (*Dendrocalamus strictus*), and the tree growth elsewhere is poor, both in quality and species, and the Forest Department is helping the reproduction

The timber, as a rule, is not of good quality and size, but is valuable in the absence of better kinds in the vicinity. There is, however, a good deal of advance growth at the lower levels: where this is wanting it is proposed to aid the natural reproduction artificially.

Teak seldom grows here much above 8 inches in diameter, the timber being much heavier and the concentric rings much closer together. This is probably due more to its growing on a hard laterite soil, the growth, however, being small and stunted, and having generally an appearance of arrested development. The Herikalgudda is peculiarly adapted for the growth of gallnut trees (myrobalams). In a favourable season the production of gallnuts has amounted to nearly 5,000 maunds, realizing Rs. 5,000 or more. The galls of this forest are much valued on account of their weight, their bright yellow colour and the greater percentage of tannin they are said to possess. These are sold at much higher rates than the nuts grown on trees elsewhere in the district if not in the province. Noticing the spontaneous growth of this tree in the forest, its speedy attainment of fruit-bearing power at the early age of 6 years, its longevity for upwards of 150 years as other arborescent plants, and the large revenue to be derived from it, all efforts to encourage reproduction are being directed towards Alale (*Terminalia Chebula*), the most valuable species in the forest.

The *Phyllanthus Emblica* grown here is noted for its flavour; and the size these gooseberries attain is immense, and is peculiar to Herikalgudda, and Herikalgudda alone, in the district.

The much-valued satinwood tree (*Chloroxylon Swietenia*) is found growing in this hill forest. These trees, though of large size are of great age, so that most of them are hollow and useless. Some measures to aid the natural reproduction of this plant may not be unprofitable.

Sandalwood grows in this forest among rocks where the soil is good, and the trees in such places though small contain more oil, and have a better perfumed wood, especially where the soil is red and stony. The soil of the Herikalgudda Forest being generally white, stony soil, Sandal arrives at maturity between 16 and 20 years; and though the growth is stunted, the wood is heavy and has an excellent scent, with a pale red color.

Tangadi (*Cassia auriculata*) is plentiful on the outskirts of of the hill, and bears flowers and fruits without cessation, and when in flower gives a brilliant colouring to the landscape. The royalty on the bark of this plant is fixed at Rs. 20 per cart-load; and there are many other products which can largely be developed, but for the inaccessible nature of the forest.

This State Forest has been supplying fuel for a few stations close to it on the S. M. Ry., and nearly 20,000 tons of fuel have been felled and removed. The cutting of fuel is conducted on coppice principles, and the forest coppice growth is expected to come up well.

Though this is a deciduous forest, the trees are only more or less deciduous in the dry months of January, February and March, and the forest is never entirely bare, for many trees burst into flower in February, and leaf themselves rapidly, before others have finished shedding their leaves. Still, these tracts have a forlorn appearance in the hot season. But in a favourable season this hill tract is not wanting in those charms of wood and water which tend to soften the harsher features of a rugged landscape, for though the summits rear themselves bare-headed, the slopes are tolerably clad with forest, through which the shining water-courses flow, and supply the vast expanse of tanks below. There are numerous kattays or depressions embanked for the collection of water throughout the hill.

Several systems of improvement of this forest are engaging the attention of the District Forest Officer. Under the systems contemplated, and under a regular system of carrying them out, this extensive hill forest will at some future date become a mine of wealth to the State.

To a shikaree this forest is not less enticing, for these rocky hills give shelter to numerous wild beasts, among which the tiger, cheeta, bear, spotted deer, wildpig and porcupine are most common.

N. N.

The Hill forests of Bashahr.

Bashahr is a hilly tract of land, stretching southward from the Chinese frontier down to Kotgarh in the Sutlej valley. On its west lies Kulu, separated from it by a vast chain of snowy mountains, and its eastern boundary rests upon that main ridge which forms a division between the Jumna and the Sutlej drainage areas. Simla, the largest sanitarium in the Punjab, better known as the summer capital of the Indian empire, is situated on this eastern ridge.

The whole country is drained by the Sutlej. Numerous streams which flow down Bashahr hills run into this river; the chief among these are the Baspa, the Wangar, the Ganwi and the Nogli rivers. The largest of all these tributaries is the Baspa river, which takes its rise from Chor Ghati, and joins the Sutlej at Karcham, some five miles above Kilba, at which latter place are the head quarters of the Bashahr Forest Divisional Officer.

Above Karcham the district divides itself into two valleys :

- (1) The Baspa Valley, which adjoins the Jumna Valley.
- (2) The Spoo valley.

Between these two valleys rises the mount Kailas, whose loftiest peak is above 21,000 feet high.

The whole district is rocky. The slopes exposed to south and east are generally without much soil on them. Such slopes are of course bare more or less according to their circumstances.

The slopes facing to west or north-west are, however, gentle and moist. The greatest part of these latter slopes is covered with forest growth. The rocks above Rampur are generally crystalline—either gneiss, granite or mica-schist. The arable area is scanty, for which reason the district is not well populated.

The men are generally of idle habits. They still keep the old custom of polyandry among them, consequently a large number of females have to lead an unmarried life. And in the upper portion of the district, where Buddhism prevails, many females voluntarily become nuns.

It is of course a well-known fact that the character of the forest vegetation depends much on the influence of climate. Perhaps nowhere in the Punjab is the difference in the vegetation of the dry and moist regions so sudden and marked as it is in this district. I may therefore divide the Bashahr forests into two regions of climate—

(1) The forests below Wangtoo in the moist region, with an annual rainfall above 18 inches.

(2) The forests above Wangtoo in the dry region of climate.

It is of course true that besides climate there are other causes as well, such as soil, aspect and altitude, which have a great influence on vegetation in the hills, but it should be remembered that in this paper I would always speak of otherwise similar localities under these two different climatic divisions.

Before we cross Wangar bridge the appearance of the olive trees, which are found scattered on dry slopes all about there, brings home to our mind that we are now in the dry region of climate.

The following trees of the moist zone may be mentioned, amongst those which we leave far behind at *Nachar* and in the Ganwi and Nogli valleys where the rainfall, at least, during the rainy season, is often great. The holly, the grey oak (*Quercus incana*), *Albizia julibrissin*, *Rhododendron arboreum*, *Rhus semialata*, *Corylus colurna*, *Andromeda ovalifolia*, *Symplocos crataegoides*, *Cornus apitata*, *Prunus Padus* and *Prunus Puddum*.

Again there are others which extend to the vicinity of the dry zone, but gradually disappear at or near Wangtoo. The principal trees amongst these latter are the following :—

Pistacia integerrima, *Pinus longifolia*, *Æsculus indica*, the hill mulberry, *Acer caesium*, *Rhus Wallichii*, *Rhus Cotinus*, *Ulmus Wallichiana*, *Buxas sempervirens*, *Cedrela serrata*, *Cornus macrophylla*, *Quercus dilatata*, and *Q. semecarpifolia*.

The numerous shrubs such as *Zanthoxylum*, *Prinsepia*, *Berberis*, *Desmodium*, *Viburnum* and Brambles, as also various ferns and climbers of the moist climate all vanish in the dry region.

Now I proceed to consider the vegetation of the dry zone above Wangtoo. The following species are quite absent in the moist zone. They may be said therefore the most characteristic trees of the dry climate :—

Pinus Gerardi, *Juniperus excelsa*, *Quercus Ilex*, *Olea cuspidata*, a small leaved ash, the poplars, the almond trees, as also the different varieties of grape vines. But the most important trees of the Himalayas do not confine themselves to one zone of climate or the other, though they may not attain equal dimensions under both these circumstances. The principal individuals among them are the following :—The deodar, the blue pine, the two firs, the birch, the alder, the walnut, *Celtis australis* and the yew. Among the fruit trees, the apricot, the peach, the pomegranate, the pears, as also the Spanish chestnut may be mentioned as occurring both above and below Wangtoo.

Climbers are generally absent above Karcham, and ferns and grasses are scarce ; while amongst the shrubs some varieties of *Indigofera* are present.

As we penetrate further on into the dry region the number of already few species begins to decrease. Thus the yew disappears at Baring, the olive and the alder both vanish at Purbani, the two first hardly extend as far as Rispa, the deodar does not go further than Morung, while the only trees we find at Neysing are the birch, the edible pine, the apricot and the blue pine ; the last named tree is of course either very small or not unfrequently mere shrub. Thus, we see that some trees cannot exist without excessive moisture ; such are the *Rhododendron*, *Andromeda*, grey oak, &c. ; while there are others which extend to the vicinity of the dry zone and there disappear ; such as the horse chestnut, box and *Pinus longifolia*.

Again, there are some species which would hardly be found except in localities where the annual rainfall falls below 18 inches ; such as *Q. Ilex* and the Pencil Cedar, while there are still some which would grow both in the dry as well as in the moist climate. Deodar is one of such trees.

Again, some species belonging to the last class of trees grow equally well under both climates. For instance, the apricot starts below Simla, and extends far in the interior in the arid zone, while there are others among them which show a preference for either of the two climates. The blue pine may be mentioned as representing such trees. This pine which is very commonly found in Kulu, and extends over a very wide-spread area in the Nogli and the Ganwi valleys in Bashahr, and also forms extensive forests in the moist climate below Wangtoo, although it extends far to the vicinity of the arid zone, where the deodar does not approach it, is generally sparingly found in the dry zone of climate in the Spoo

Valley. I am inclined to believe that the real region of distribution of this pine is in the moist climate.

In the dry region above Karcham the deodar is found either almost pure or mixed with the edible pine, where the blue pine is sometimes either rare or quite absent.

The scarcity of this pine in such forests may be due to some other causes as well, the principal cause among which may be mentioned the soil.

As a rule the upper portion of the hills occupying the Spoo Valley holds very little soil, and generally remains under snow for the greatest part of the year. The lower slopes are of course in many places clothed with forest growth. Viewed from a distance the soil of these forest-clad areas looks more like that of the abandoned bed of a river than anything else. It is free as flour, and is generally very stony with a large admixture of sand, and contains a large quantity of mica as well. It seems to have been formed mostly by the disintegration of the crystalline rocks occupying the upper summits of these hills, and as a natural consequence therefore it follows that the soil of these localities is as dry as the climate itself.

To such dry climate and dry soil conditions the edible pine adapts itself very wonderfully. This pine is satisfied with the very poorest soil, and sometimes it requires little, or I may say, no soil at all. Hardly any fissures in the rocks remain unoccupied by this three-needled pine of the dry climate. In this one particular it may be said to out-do its sister pine of the moist climate, which it so closely resembles in all its habits.

Amongst other trees, which are sometimes found mixed with this pine under such circumstances may be mentioned *Q. Ilex* and the small leaved ash.

In such forests the deodar eventually gets in. The pine fosters it when the cedar is young, and simply disappears when it is no longer required.

To such process may be attributed the existence of almost pure deodar forests at Ralli, Tangling, Powari and other similarly situated localities in the Spoo Valley.

But the Blue pine refuses to persist under cover over head. The natural conditions, as regards both soil and climate, are also far from being favorable for the natural growth of this pine in the unshaded areas. Consequently, it is generally sparingly found in this valley. In places, however, where the soil is comparatively moist the blue pine is not much wanting; as an instance of such a type of forests may be mentioned the Mehbar and the Purbani forests of the dry zone of climate where fine specimens of it are present.

It may be true to some extent that both the climate and the soil account for the rareness of the blue pine in the Spoo Valley ; but it is certain that under a more favorable climate the tree would have sooner occupied such a poor soil than any other species. I believe, therefore, that the real home of this pine is in the moist climate.

Should it ever be desired to introduce deodar in the above localities by some artificial means, it should never be attempted in places where the edible pine itself, or some of its companions, are not present. For instance, if we ever try to grow deodar in the Tangling or the Powari forests, where the rainfall during the monsoon seasons is almost *nil*, where not a single drop of water is present in the soil, and where the soil is as poor as it can possibly be, we should always, under such circumstances, use the edible pine as a nurse for the young plants of the cedar. Our all attempts to raise the deodar otherwise are sure to result in failure.

Similarly marked difference exists between the fauna of the moist and dry regions in this district. I believe, therefore, that a few words about these denizens of our forests may not be without some interest. The baboon, the barking-deer, the '*eemu*,' are quite absent above Wangtoo, where these animals are replaced by the sheep and the Ibex.

The little hardy monkey of the plains is not uncommon above Wangtoo, but the numerous pheasants of the moist zone are generally scarce, if not quite absent. On the other hand, the snow-pheasant, which we seldom find anywhere below Wangtoo, is not rare in the dry zone of climate.

The Chamois goat is also very sparingly found above Karcham, but the Thiar (the Kirth of Kulu) does not confine itself to one zone of the climate or the other, though it is seldom found far up in the valley. The musk deer is generally more commonly found in the dry zone.

Among beasts of prey the common leopard is generally sparingly met with above Karcham, while higher up in the valley the snow-leopard replaces it. The black bear is not so common in the dry zone as it is in the moist region, but the brown bear is not wanting above Karcham. Similar differences occur among the domestic animals of these two different zones.

Thus we see that climate is the most powerful element which regulates all important changes in the forests of this region.

KAILAS,

MIAN MOTI SINGH.

The 20th April 1894.

Note on the Occasional Formation of Pseudo-Autumnal Zones of Wood.

In Hartig's "*Anatomie und Physiologie der Pflanzen*," which I am now engaged in translating into English, the following passage occurs at page 261 :—

"Throughout the tropics many ligneous plants exhibit no definite annual rings because their cambial activity is never interrupted. Differences in the structure of the woody tissue, occasioned by changes in the temperature and in the humidity of the atmosphere, can still occur without indicating any definite limit as to the quantity of wood produced in each year. Other trees within the tropics, however, plainly exhibit annular rings, owing to the fact that at the commencement of the dry period a cessation of vegetation takes place, which resembles the approach of winter in the temperate zones."

In the above passage a clear indication is given of the nature and cause of the occasional occurrence of what seem to be two annual rings during one season of vegetation. Thus, for example, during the hill tour of the students of the Forest School in the Jaunsar division at the present time, in counting the annual rings of deodar (*Cedrus deodara*) trees it is sometimes noticeable (*e. g.*, at Deota, elevation about 8,500 ft.) that a close autumn-like zone of dense tissue is to be found about the middle of the annual layer,—a zone that might easily be mistaken for an annual ring.

The explanation appears simple. During the winter months even the evergreen conifers do not *grow*, they merely transpire through their foliage. With the advent of warmer weather in spring and the stimulation of the root-system, owing to the rise of temperature in the soil, the active period of vegetation is entered upon. At first it is feeble, and during this stage a portion of the reserve nutrients stored up in the form of starch is re-transformed into grape-sugar and utilised for various constructive and expansive purposes ($C_6H_{12}O_5 + O$ becomes re-converted into $C_5H_{12}O_6$). But with the gradual increase in atmospheric temperature the energy of growth becomes enhanced, and during the latter half of April, throughout May, and until the advent of the monsoon rains at the end of June, or the beginning of July, the vegetative activity is decidedly great. In consequence of the bright sunshine and the high temperature the woody-fibrous tissue is rapidly developed, the cells expanding considerably so as to form a broad spring zone.

With the arrival of the rains, however, the vegetative energy receives a check owing to the decrease in the temperature, and to the fact that the humidity of the air approaches the point of saturation. Combined with these there must also be a decrease in the intensity of the rays of light; but this may not be, and probably is not, so great as to interfere to any appreciable extent with the process of

assimilation. In consequence of the air being saturated with moisture during July and August the normal process of transpiration is directly interfered with. Despite the fact that, in order to stimulate transpiration, the stomata become enlarged automatically with any increase in the relative humidity of the air—just in the same way as they contract during very hot and dry weather, so as to decrease the rate of transpiration—it stands to reason that their task can only be very incompletely fulfilled when the whole of the woodland air has reached almost the limit of humidity, the point of saturation. With transpiration thus checked, assimilation cannot proceed as actively as was the case during the warm, dry months of April, May, and June; hence the cells of the wood formed during the two wet months of July and August expand less during the process of formation, and assume a dense appearance, closely resembling the true autumnal zone of the annual ring.

It will of course be apparent that, with this simultaneous fall in atmospheric temperature and diminution of vegetative activity, the *bark-pressure* will become increased, whilst the *counter-pressure* from within, *i.e.*, the expansive power of the cambial-cells engaged in the formation of new woody-fibrous tissue, will at the same time become weaker; and these conditions will considerably affect the size attained by the new cells in process of formation during the two wettest and coolest months of the S. W. monsoon season. Whenever the bark-pressure from without exceeds the counter-pressure from within, the formation of a pseudo-autumnal zone must take place; but when the opposite pressures are almost equal no such distinct line of demarcation need necessarily be visible. This would explain the fact that such pseudo-autumnal zones do not invariably run all round the periphery of the stem.

With the cessation of the heavy rains the relative humidity of the atmosphere decreases, and the temperature again increases considerably, so that during September and the early part of October there is a renewal of very active assimilation and of wider extension of the cells during the process of development. That is to say, after a dense pseudo-autumnal zone has been formed in July and August there follows a large-celled zone which appears, by contrast, to be a new layer of spring wood. During the autumn months, however, the true zone of autumn wood is produced normally, which plainly indicates the termination of active vegetation for the season, and shows that the tree has entered into the dormant period of the year.

In the Chir (*Pinus longifolia*) tracts of Jaunsar an analogous cessation of active growth during the wet and comparatively cold months of July and August makes itself felt with regard to the resin-tapping operations. The latter begin in the early part of May when once vegetative energy has become active. A good flow of resin, increasing with the temperature, continues till the air becomes cold and saturated with moisture in July. During July and August the result of this climatic change is that the outflow of resin

all ; but it is stated—a statement which I am not yet able either to confirm or to dispute—that young stool-shoots of this tree thrown out as coppice at Lakarkot on the Southern side of the Siwaliks (Saharanpur division), and known to be of a certain age, have apparently a larger number of dense (autumnal and pseudo-autumnal) zones of wood than corresponds with the number of years indicating their age. If this be the case, then the formation of these *pseudo-autumnal* zones must in all probability be ascribed to the climatic changes previously adverted to as occurring in July and August. The elevation of the Lakarkot coppice is about 1,500 feet, and the southern slopes of the Siwaliks receive the full burst of the monsoon, so that these climatic changes with regard to rainfall, temperature, humidity, duration of sunshine, and intensity of light will all be much more emphasised and strongly marked than if the forest growth were situated on the plains of India at a lower elevation, or even if it were on the northern slopes of the Siwaliks and at a somewhat higher elevation.

It has been asserted that the Teak tree sometimes exhibits a number of concentric zones of woody tissue exceeding the number of years in the age that the poles are accurately known to have attained. In thinnings conducted throughout many of the Teak plantations of lower Burma I have never met with such a case. But it seems to me that if they can be proved, a very plausible explanation may easily be given.

In a former number of the *Indian Forester* I pointed out that the Teak plantations of lower Burma are occasionally liable to be almost totally defoliated during May by the caterpillar of an insect which seemed to me species of *Tortrix* (*Tortrix Tectonae*?), but which, as was pointed out by Major Bingham subsequently, really are two insects, *Hyblæa puera* and *Paliga damastesalis*. After a period of defoliation and dormancy, extending from about the beginning of February till about the end of March, the Teak flushes its spring foliage. In the hot day air of Burma during April and the early part of May the process of active vegetation is extremely energetic ; but, during years when the above caterpillars commit their ravages, the trees are practically stripped of their foliage before the end of May, and remain in a leafless condition till the summer flush of foliage comes out in July. Whilst the larvæ are feeding in countless swarms the normal processes of growth *must* be very seriously interfered with ; consequently the formation of a pseudo-autumnal zone of woody-fibrous tissue *may* be the result. Whether such a result actually occurs can easily be tested by examinations of the annual rings during the next thinnings, and by finding out from the plantation journal if any bad attacks of caterpillars took place during the years in which pseudo-zones appear to have been produced.

That such pseudo-autumnal zones of woody fibrous tissue are not infrequent in the case of many Indian trees seems to admit of

no doubt. And although it has no direct bearing on forestry, yet the matter is of much more than merely passing interest from a physiological point of view : hence it might be advantageous if men serving in different parts of India would kindly give their brother officers the benefit of any observations and deductions they may have made on the subject.

Camp Deota, Jaunsar
19th May, 1894

J. NISBET.

The Gutta-percha Industry.

(From the "*Revue des Eaux et Forêts*," extract from "*Le Bois*" of 10th January 1894.)

Although it is not a product of the forests of Europe, with which the following article deals, yet it is a matter of considerable interest to follow the course of a most curious industry, which is closely connected with electricity and silviculture. It is well known that gutta-percha is an indispensable article in electrical engineering, as it is the only insulating substance which can be used as a protective covering for conducting wires where in contact with other objects. All endeavours to replace gutta-percha for this purpose have failed.

In 1889, its price was 9 francs the kilogramme, in 1890 it reached 13 francs, and in 1891 17 francs. To-day the price is still higher, and it is steadily increasing.

Gutta-percha is almost exclusively obtained from Malaya, it is the sap of the *Isonandra Gutta*, a large tree which is fairly abundant in that region. The tree does not produce gutta-percha until it is full grown, *i. e.*, after about 30 to 35 years. Its height is then as much as 100 feet and diameter about 3 feet on an average.

The mode of extracting the gutta-percha as practised by the natives is very simple. The tree is first felled and allowed to remain for some time, then a strip of bark is cut off longitudinally, and from this cut the gutta-percha slowly flows. Tapping of standing trees has been tried, as is done in the collection of resin, in order to prolong the period of production, but without success, the sap refuses to flow until after the tree is dead.

The material obtained as above is in a more or less pure state, but from the natives it passes into the hands of the Chinese, who mix various other substances with it in order to increase the weight, and it is only available for use after it has further passed through the hands of a series of traders whose business it is to boil it and increase the volume at the expense of the quality. As a result of this, for some years past the quality of the gutta-percha commerce has been steadily deteriorating, and to obtain the same effect a large and larger quantity has to be used.

The method of extractions employed by the Malays presents another serious drawback as regards the future; and this is that as the trees are felled just at the time when they are becoming capable of producing seed, reproduction is prevented, and the forests are thus being rapidly depopulated. Attempts have been made to acclimatize the gutta-percha tree in other countries, and more particularly in the French colonies, and there are doubtless in the Indo-Chinese colonies, Madagascar, and perhaps even in Algeria, large tracts of land where the condition would be suitable for the growth of this tree, resembling as they do in most points the conditions which obtain in its native country. These endeavours are praiseworthy and deserving of encouragement, but they do not, nevertheless, provide for the urgent requirements of the present, for, as mentioned above, it requires 30 years for the *Isonandra Gutta* to attain that degree of maturity necessary for the production of gutta-percha; and however desirable it may be to provide for future requirements, the first thing to be done is to assure the present supply.

For this purpose, experts were sent from France to Malaya to study the question from an industrial point of view. These have recently returned; and from the information given in the last bulletin of the Society for the Encouragement of National Industries it appears that a solution is about to be arrived at. It was noticed that the flow of gutta-percha was obtained by allowing the felled tree to continue its vegetative functions for a time, so far as the performance of these functions is possible by the aid of the leaves which are not removed from the stem.

This fact suggested the possibility of the gutta-percha, which distils from the bark, originating, in the first instance, in the leaves themselves, and consequently the possibility of obtaining the gutta-percha direct from the leaves without felling the tree. Experiments have proved the correctness of this supposition. Both dry and green leaves have been submitted to chemical treatment with a view to separating out any gutta-percha which they might obtain, with the result that by a comparatively easy and cheap process a yield of 9% has been obtained.

The leaves of one tree entirely defoliated give as much as 1,000 to 1,100 grammes of gutta-percha, whereas the tree itself only yields 265 to 270 grammes. Supposing that not more than half the leaf cover is removed, the other half being left to support the growth of the tree, this will still give a yield double of that hitherto obtained. The product thus obtained is accepted by importers at the same rate as the old or original article, and apparently for commercial purposes the two are identical. Investigation is still going on, and leaves are being received from different quarters to be tested in the laboratories, so that a definite result should soon be obtained, and if the conclusions hitherto arrived at are thereby confirmed, it is certain that the price of gutta-percha will soon begin to fall rapidly.

A. F. G.

III.-OFFICIAL PAPERS & INTELLIGENCE.

Grass-farming in Coimbatore.

Attention having been drawn to the operations of the Commissariat Department in Northern India in the matter of the growth of grass to supply the requirements of Military departments, chiefly by conserving wild land, it was considered advisable to obtain a full report on the system followed by private stock owners in the Coimbatore district in the laying down and management of permanent pastures. The report has been prepared by Mr. C. K. Subba Row, Sub-Assistant Director of Agriculture, and is given below. It may, however, not be out of place to quote here the following references to the custom and allied matters extracted from Mr. Nicholson's Manual of the Coimbatore District. He remarks that "a marked feature (of the agriculture practice) of much of the district is the fencing, which is almost peculiar to the Kongu country; it is found over most of Coimbatore, in parts of Salem, especially near Coimbatore, and in the Palni taluk of Madura. The habit of breeding large herds of cattle, the high winds, and the absence of any general custom of exchanging lands, probably induced this practice. From time immemorial large fields have been well fenced either with mullu-kiluvei (*Balsamodendron Berryi*), something like a strong English bull-fincher, or with various species of Euphorbia and Cactus, including prickly pear. The practice of fencing is very valuable, cattle trespass being comparatively rare, cattle and crops protected, boundaries respected, large quantities of fuel supplied, and protection given to growing trees." The practice allows of the growth of pasture, regarding which he says:—

"This all-important subject receives little attention, though more than has been supposed. In taluks, such as Dhárápúram and Karúr, many fields are permanent pastures, either natural or sown. The fields, though stony, afford a good deal of pasture between June and February, but very little is to be found during the hot interval, and it is this trying break that, where forests and hills are not available, prevents cattle from thriving as they might; disease also frequently breaks out after the first rains, when the sudden growth of grass is greedily devoured. The herbage is coarse, wiry and tussocky, and there is no sward as in English pastures. Artificial pastures are comparatively rare, but in some

‘taluks, notably the above two, the practice of ploughing and sowing lands for pasture is practised. Hariali (*Cynodon Dactylon*) and an indigenous grass called kolei-kattei are sown, the latter most frequently; it is a very tall wiry grass, running rather to tussocks, so that a Coimbatore pasture little resembles those of England. It gives good feeding to judge by the prices paid. The lands are ploughed in the hot-weather rains and grass seed sown either by itself or mixed with cholum, gingelly, &c.; if the north-east monsoon is good, cattle are turned in to graze in the following January, nine months after sowing; they graze through the hot weather till the early rains of the south-west monsoon. Grass is occasionally sown with gram in September, sometimes with kambu in July. The land is usually manured when the grass is sown, and thereafter the cattle grazing on it for several months in the year manure it. The pasture lasts for many years, and is then again ploughed and resown, or broken up for crops. Pasture growing is often a better speculation than crop growing, as a field of 8 or 10 acres will be grazed by as many cattle at from 4 annas to 1 rupee per month for several months. In addition to the grasses sown (usually hariali and kolei-kattei), other grasses, such as vennei, mattankáy (*Cynosurus egyptiaca*), ilei (*Panicum marginatum*), sourikodi, and naripayathán-kodi grow spontaneously. No attempt is made to adapt the soil or to use other grasses.

‘It has been supposed that the district once abounded in good grass lands, that these have disappeared and been brought under cultivation, and that this, especially as regards the best pastures, was brought about by a change in the assessment some years ago, by which ryots, who had been accustomed to hold pasture lands on puttah at one-fourth of the assessment, were permitted to do so only if no other person was willing to take up the land for arable culture at the full rent.

‘It must be clearly understood that the grass lands of which the ryots bemoaned the loss, and ‘the jungle’ supposed to have disappeared, are one and the same, viz., the poorest dry lands wholly untilled and occupied and producing on their stony and sterile surface a few straggling and stunted bushes, and a little coarse, hardy grass. The better grass lands held ancestrally by the ryots have been broken up by their owners at their own pleasure and for their own profit, and the increase in occupied area has, on a comparison of existing facts with Mr. Hodgson’s description, led to a great increase in tree growth.”

The grass most commonly grown in the district is the *Kolei-kattei*, which the Government Botanist identified in 1887 as being the *Pennisetum cenchroides*, Rich. Regarding this grass Mr. Duthie, in the Dictionary of the Economic Products of India, says that it is “a most excellent fodder grass, thriving best where the soil is sandy, in the Multan district it is considered to be the best grass to give to milch cows. Would probably repay cultivation.”

Mr. Subba Row's report on the system of grass-growing in the district is as follows :—

“The origin of the name ‘*kolei-kattei*’ as applied to the grass is obscure. ‘*Kolei-kattei*’ literally means a preparation consisting of fried cocoanut scrapings or gingelly mixed with jaggery, enclosed in a sac of rice flour and steamed, which is particularly acceptable to *Ganésa*. No part of the grass, however, presents any likeness to *kolei-kattei*. Some ryots were of opinion that the name of the grass is really *kolukkatti*, which means ‘proof against the ploughshare,’ as the grass is not liable to be exterminated by any number of ploughings, provided the roots are not gathered off.

‘Owing to the long-continued drought, the grass was met with in tussocks, which were quite parched up. In Palayakottai, however, I saw it in a green state, about 1 foot high, amidst a cholum crop which had been manured with sheep manure.

‘The grass has what is called a creeping stem with suppressed internodes, the stalks above ground being really branches. Each plant tillers at every joint, corresponding to each leaf bud, where a separate set of roots is given off, making in all from 50 to 100 adventitious roots when well grown. The plant may be transplanted with success at any stage of growth. The Palayakottai Pattagar says that even when the grass has ripened its seed, it may be transplanted several hours after being pulled out, provided the roots are kept moist. The grass is stimulated to comparatively good and rapid growth by showers of rain too light to have any effect on other grasses. Though the grass may apparently die during a long-continued drought, it is revived by one smart shower. The vitality and propagating power of the grass are thus remarkable. The roots of the grass are very short, being scarcely three inches long even in very old pastures. The grass may, therefore, be easily cleared off the land by ploughing a few times and gathering off the roots.

‘The great preponderance of dry land and the scarcity of hills are causes, so far as I can observe, of a large proportion of the occupied area being left waste for pasture and of large areas being cultivated with *kolei-kattei* grass, and of cholum and narippayir (*Phaseolus trilobus*) being cultivated for fodder exclusively.

‘Grey loamy soil, which, I believe, is rich in lime, is considered the best for *kolei-kattei* grass. Next comes red loamy or sandy soil with fine particles. Black cotton soils, which are comparatively friable, and soils derived from the disintegration of masses of agglomerated limestone, come next. Soils on old village sites, or fields which, on account of their close proximity to villages, are used by villagers as public latrines, are also very good. It is desirable that the land for *kolei-kattei* grass should have a gentle slope, so that rain water may drain off easily. If the slope of the land be not gentle enough, high bunds, like those of tanks, are raised so as to retain rain-water sufficiently long on the land and

'then let it off. Bunds constructed for this purpose (not only on account of the grass, but also on account of other field crops) are such a common feature in the Kángyam division as to lead to the supposition that tanks are very numerous there, until it is seen that the bunds have no sluices or waste weirs, and that there are no crop irrigated under them. I observed that on the low lying strip of land close to the bunds not a blade of *kolei-kattei* was to be found, stagnant water being particularly injurious to this grass. The grass is said to be spoiled if water stand on it for more than a day. I saw that *hariali* grass and *khanampul* had superseded *kolei-kattei* in the hollow places adjoining tank bunds. Stiff soil are unsuited to *kolei-kattei*.

'The grass is seldom sown by itself. As a rule, it is sown on the same land as and immediately after (1) gingelly, (2) cholum or (3) cumbu is sown, or (4) amidst a crop of *nadam* cotton in the last year of its growth. There are two seasons for sowing *kolei-kattei* grass, viz., the *kar* (from April to June) and the *paruvum* (from August to October). Gingelly is said to be the best crop with which to sow the grass, and the *kar* season is preferable for sowing it. It is undesirable to stir the soil till three years after sowing *kolei-kattei* grass, and, as gingelly needs no interculture in the *kar* season, the grass is sown in the majority of cases immediately after gingelly. As a rule, the land on which the grass is sown is manured with sheep manure. Next to gingelly, cholum is the crop with which the ryots prefer to sow the grass. This may be done either in the *kar* or in the *paruvum* season. The grass gets a far better start and grows much better if sown in the *kar* than if sown in the *paruvum* season, provided there be good rainfall in that season. But, as the *kar* rainfall is precarious, the grass is sown in most cases in the *paruvum* with cholum or more rarely with cumbu. In the latter case, it is only after the cumbu crop has been bullock-hoed that the grass seed is sown, interculture being essential for cumbu and destructive of the young grass. The grass seed is invariably sown on the surface, and the soil is not stirred afterwards, nor is the seed covered in. The seed should not be more than a year old.

'If the soil be moist enough, the seed germinates about six days after being sown. A shower of rain enables the grass to secure good hold on the soil. The grass is said to be benefited by the wind which blows pretty strongly from May to August, as it heaps up very fine soil against the stalks, which affords not only additional food to the plants, but also shelter to the roots. Two months after sowing, the grass begins to flower, and it is then as high as a man's waist. The Pattagar says that he has known the grass to attain a man's height under very favorable circumstances of soil and rainfall. About three months after sowing the grass seeds.

'As a rule, cattle are not let in to graze on the new fields till at least six months after sowing. If seed be sown in May or June,

the grass will be fit for grazing by December, and if it be sown in July or August about February. In some cases cattle are allowed to graze immediately after the ears ripen and shed their seed; that is about four months after sowing. If cattle be let in too soon the plants may be pulled up by the roots on being grazed. Very great care is taken during the first year that neither sheep, goats, nor ponies have access to the grass, as these animals bite the grass close to the ground and thus kill it.

Kolei-kattei grass-land is securely fenced with mullu-kiluvei (*Balsamodendron Berryi*) against the trespass of cattle and sheep, which would otherwise keep the grass down. The size of an enclosure is never less than about 4 acres. On large estates where large numbers of stock of different kinds are kept, as at Palayakottai, the size of an enclosure may be 100 to 150 acres. Once in three years the fences are cut, when they present large gaps below, and the cuttings are in most cases planted close to the old fence so as to make it more dense.

If the grass be sown in the *kar* season, cattle are let in to graze, as said before, about December, and go on grazing till March. They are then kept off the land till about a month after the grass has been refreshed by the next *kar* rains, and are then allowed to graze till rain falls in July or August. For about a month afterwards, the cattle are kept off the pasture, and then they go on grazing till even February or March. If there is more grass than the cattle can eat, it is cut before it becomes over-ripe, that is, soon after flowering. Grazing is generally available for cattle for about eight or nine months in the year from the second year forward. On large estates, like that of the Palayakottai Pattagar, breeding bulls and working cattle graze in separate enclosures, so that the vigorous and spirited bulls may not tease and injure the bullocks. Separated enclosures are also allotted to carrying and to empty cows; with the latter breeding bulls are allowed to run. The Palayakottai Pattagar says that two *vallams* or about $7\frac{1}{2}$ acres of *kolei-kattei* grass afford sufficient pasture for a pair of cattle for about nine months in the year, *viz.*, for about three months in the *kar* season and about six months after the *paruvum* rains have set in, and that the cattle would require to be fed with cholum straw or other fodder during the remainder of the year.

Ordinarily, cattle are not left on pasture ground during the night, for fear of thieves and snakes. Young stock and cows generally graze from sunrise till sunset. Under such circumstances, a *vallam* (3.82 acres) of excellent land will support in good seasons 20 heads of cattle for 30 days on the whole during the year. So, about $2\frac{1}{2}$ acres of good pasture in good seasons will give enough grazing for each head of cattle throughout the year.

As said before, young stock and cows graze generally from sunrise till sunset. But from January to March they are turned

‘ out to graze at 3 or 4 A. M., for the grass, being then wanting in
 ‘ moisture, is best eaten when it is wet. with dew, and in the hot
 ‘ season also they are sent out to graze very early ; for, during the
 ‘ heat of the day, cattle leave off grazing and seek shelter under trees.

‘ Sheep are only allowed to graze the stubbles left after the
 ‘ cattle. The stubbles are said to be about a span high. Stock of
 ‘ all kinds thrive best on tender grass which renders the skin glossy.
 ‘ Ponies prefer hariali grass and do not eat *kolei-kattei* grass unless
 ‘ it is tender. Cattle thrive on *kolei-kattei* grass better in the *kar*
 ‘ season than in *paruvum*, although grass may be abundant in the
 ‘ latter season ; for they are worried by seekadi, an insect pest, and
 ‘ also do not drink water freely in *paruvum*.

‘ Under average circumstances *kolei-kattei* grass appears to be
 ‘ rented at about Rs. 15 per *vallam* of 3.82 acres, the owner paying
 ‘ the assessment, which is about 12 annas per acre on the average.
 ‘ There is thus a profit of about Rs. 3 per acre.

‘ At intervals of three or five years the grass land is plough-
 ‘ ed immediately after a shower of rain at the end of the hot season,
 ‘ before the tussocks show signs of fresh growth. The furrows are
 ‘ ordinarily about four inches apart. The Palayakottai Pattagar says
 ‘ that he ploughs and also *cross-ploughs* his grass land at intervals
 ‘ of about five years, and that there is not the slightest danger of the
 ‘ grass being killed by close and repeated ploughing, unless mois-
 ‘ ture be wanting in the soil and rain hold off for long after the
 ‘ operation. When the grass has once matured its seed, no crop is
 ‘ usually sown on the land with the grass ; but I saw two extensive
 ‘ fields, sown with *kolei-kattei* grass years ago, cultivated with
 ‘ cholam this year, in Palayakottai. In one of the fields cholam
 ‘ was still standing, and on account of the tillage and the sheep
 ‘ manure which the land had received previous to cholam being
 ‘ sown, the grass was very luxuriant. This is very remarkable and
 ‘ interesting, considering the fact that nowhere else did *kolei-kattei*
 ‘ grass show any sign of life. Besides the tillage and the manure,
 ‘ the partial shelter afforded by the cholam plants accounts for the
 ‘ grass being in such comparatively good condition in these two
 ‘ fields. As a rule, the only manure which *kolei-kattei* grass gets is
 ‘ the dung of the stock grazing it. On very high ground consist-
 ‘ ing of very inferior soil, it is said to be desirable to remove the
 ‘ grass altogether after a lapse of 10 to 15 years, and to resow the
 ‘ land. The grass is seldom irrigated.

‘ *Kolei-kattei* grass is sometimes cut and stocked. About three
 ‘ cuttings are obtained in the year. The yield per acre under favor-
 ‘ able circumstances appears to be 200 to 250 bundles, 9 feet in
 ‘ girth, per annum. The average yield is not less than 100 bundles
 ‘ per acre, and this, as each bundle of green grass is estimated to
 ‘ weigh about 50 lb. = about $2\frac{1}{4}$ tons.

‘ If land be simply left waste for a few years, grasses of va-
 ‘ rious kinds grow upon it ; but a given area of such land does not

‘support half as much stock during the year as an equal area under
‘*kolei-kattei* grass. The ryots do not appear to leave any block of
‘land permanently waste as a rule ; each field appearing to get two
‘or three years rest in its turn. If a piece of land be once sown
‘with *kolei-kattei* grass it is not advisable to bring it under cultiva-
‘tion again in two or three years ; and, as the growth of the grass
‘during the first year is not very good, there is no advantage in
‘laying down the land under grass if it is to be cleared in a year
‘or two, when it is well established.”

The Principal of the College of Agriculture states in a recent report on this grass that, after some twelve years’ experience at Saidápet, it has been found one of the hardiest grown there, and that apparently, if it once takes root, it does not die out easily. Even in April and May, the driest months at Saidápet, the plot under the grass is well covered.

Regarding the growth of fodder crops grown as such, which is a subject allied to the above, Mr. Nicholson in his Manual remarks that it is “rare, but the practice is known throughout the district and is occasionally followed. In the Kángyam division of Dhárápúram, where the best cattle are still reared, there is a regular practice in February-March of growing either cholum (*Sorghum*) or cumbu (*Pennisetum spicatum*) (chiefly the former) under well irrigation ; this is called adar cholum from its being sown closely so as to yield heavily, and is grown at any time that fodder may be wanted. It is cut down before earing and affords considerable provision during the hot weather. Fodder crops are not grown on dry land ; there is considerable pasture except in the hot weather, and as it is unusual to get rain sufficient even for ploughing from the end of December to 15th April, no such crops are possible except on garden lands. The ryot excuses himself from growing fodder by alleging, and with some reason, that, as his cholum fodder is little injured by growing to maturity, he grows cholum as grain crop rather than as a fodder crop for the double yield ; the expenses of well irrigation in the hot weather are considerable, and few could afford to lose the grain of the crop.” (*Bulletin 2, Madras Agricultural Department.*)

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Notes on the tour of the Forest School students in
the Western Dun and Saharanpur Siwaliks in 1894.

By H. G. BILLSON.

On Monday, January 5th, the plains tour of the Junior Forest students was started by a visit to the boom at Dakpathar. The work here was in full swing, sleepers coming down regularly and in large numbers. Drawings were made of the boom sections, windlasses and tramway, and a full description of the boom and its working given to the students.

The boom itself has been previously described in this Journal, so it need not again be referred to except to say that it was in excellent working, and that the catching of the timber was being well and efficiently performed.

THE KALSI COPPICE WITH STANDARDS.

The forest lies on the outer spurs of the Himalaya around the town of Kalsi in the angle formed by the junction of the Tons and Jumna rivers, and abuts on its eastern side on the main road from Saharanpur to Chakrata. The area managed under this system forms a Working Circle of three blocks.

The first, or Haripur Block, consists of 18 compartments; the second, or Panjgaon Block, of 6 compartments; and the third, or Barabagh Block, of 4 compartments. Of these, six compartments lying in Haripur and Barabagh, of an aggregate area of 788 acres have been excluded from the coppice area which is, without this part, sufficient for the present demand. A part of this uncoppiced area being near Kalsi, and the rest much grazed over by the cattle of Haripur, the closing of these areas would cause much inconvenience to the people of those places. The remaining area of 1,094 acres is treated under the coppice with standards system, with a rotation of twenty years, which indicates an annual coupe of approximately 54 acres. It may, however, here be mentioned that an area of 104 acres in compartment 3, Barabagh, cannot be coppiced owing to the friable nature of the soil and the possibility of landslip.

The soil is a dry, somewhat shallow sand, strewn with blocks of micaceous sandstone and quartzite. If in future it is considered desirable to increase the rotation, it can be done by bringing some of the area at present excluded, under the coppice system. As the areas coppiced are to be closed to grazing for the first five years after exploitation, this will give a total of 271 acres closed at any given time, which is one-seventh of the forest area near Kalsi, and therefore cannot be considered excessive.

The annual coupes have been arranged not so as to follow each other on the ground in regular succession, but so as to avoid the inconvenience of closing the whole of 5 years' coupes in one spot, and also to avoid the possibility of coppicing a large area of Sal one year, and perhaps none the next, as Sal is not regularly distributed over the whole area. Speaking generally, the area is incapable of producing good, high-timber forest, on account of the very shallow, stony nature of the soil, while at the same time it is most desirable to get rid of the present stock of unsound and crooked trees which have no future before them. This it has been decided to do by leaving the few well grown trees at present standing on the area, and coppicing all such as are badly shaped and poorly grown. For standards, Sal, Sain, Haldu, Gausam and Bakli, with a few others in default of these, are preferred. There are certain free grants of timber or bamboos which have to be met, and this is done, as far as possible, from the excluded area before mentioned.

It was laid down in the Working Plan that in 1889-90, 53 acres in compartment 7 were to be cut over, in 1890-91 37 in compartment 6, and in 1891-92, 33 acres in compartment 5. Owing, however, to difficulties connected with the demand, none of these areas could profitably have been exploited: they were, therefore, left over till 1891-92, when a market for the produce was opened up at Chakrata, and the wood was sold for fuel to the cantonments at that place. In 1891-92, an area of 30 acres in compartment 7 was cut over and yielded 350 cu. feet of timber and 20,540 cu. feet of fuel. This compartment, the total area of which is 53 acres, occupies the N. E. slopes of a spur between the cartroad and the foot-path to Kalsi. Its average gradient is about 35°. Sal is abundant: and the standards, which are very few in number, are chiefly Sal, with here and there a Bakli or Haldu. The scarcity of standards is due to the difficulty of finding suitable trees.

The wood was cut departmentally at a cost of Rs. 2 per 100 cu. feet of fuel (cut in 2 foot lengths.) The stools were gone over afterwards, and trimmed by daily labour at a cost of Re. 0.15 per acre. The cost of carriage to Chakrata, where all the fuel is now sent, was Rs. 1 per 100 cubic feet from the jungle to the road, and Rs. 15 from there to Chakrata by cart. In the cantonments the wood was sold at Rs. 27 per hundred cubic feet. The stools are not very well cut, but the results are, on the whole, good.

The measurements of shoots by the students of the Forest School gave :—

January 1893 :—1,016 shoots of an average height of 6 ft. 5½ inches (of which 347 were Sal of an average height of 7 ft.)

January 1894 :—461 shoots of average height of 9 ft. 1 in., of which 179 were Sal of an average of 9 ft. 1 in.

It was discovered that *Combretum decandrum*, the common climber, has begun to do considerable damage, being especially thick in the lower part of the compartment.

In 1892-93 28 acres of compartment 6 were coppiced, and measurements made there in January 1894 resulted in the following :—

670 shoots of an average height of 6 ft. 4 in., of which 179 were Sal of an average of 6 ft. 7 in.

In the same year nine acres more of compartment 7 were cut over, the two areas yielding 431 cubic feet of timber (sold locally).

19,806	...	...	...	firewood.
1,214	....	...	...	charcoal.

With the exception of the cost of carriage of material from the coupe to the road, which varies with the distance to be traversed, and that firewood now fetches Rs. 25 per 100 cubic feet in Chakrata, the rates are the same as those quoted above for 1892.

This compartment has a Southern aspect and a drier soil than No. 7, with about the same slope as the latter.

On Saturday, January 13th, the Badshaibagh coppice was visited. This area lies on the southern slopes of one of the outer ranges of the Siwaliks, about one mile to the west of Badshaibagh, which is a small hamlet lying at the point where the road from Saharunpur to Chakrata enters those hills. Its northern boundary is the ridge of the outer hills, its southern the Badshaibagh Rau, which latter also defines it on the east, and its western boundary is another ridge. The soil is dry, poor and stony, and the subsoil is pebble bed or sandstone, with in a few places a band of red clay.

Two areas of 50 acres each were cut over, one in 1888-89 and the other in 1889-90. The financial results were, however, so poor that the system was abandoned. These areas were both cut over departmentally, and the wood was auctioned on the spot. The areas are still fire-protected, and the effects of the exclusion of grazing were very noticeable in comparison with the adjoining open jungle. The chief species noticed were Bakli (*Anogeissus latifolia*), Harsinghar (*Nyctanthes arbor-tristis*), *Zizyphus* of different species, Khair (*Acacia Catechu*), Tendu (*Diospyros melanoxylon*), Salai (*Boswellia thurifera*) &c., &c.

Measurements by the students have yielded the following data :—In 1892, in part of the area cut over in 1888-89 the measurement of 424 shoots gave an average height of 7 ft. 5 in.

In 1893 the same area gave for 553 shoots an average of 8 ft. 3 in., and in 1894 589 shoots gave 9 ft. 1 in. A visit to the areas was, however, useful as affording an example of the results of coppicing a piece of jungle of poor nature on a hotdry slope.

The results are in places not bad, the condition of the crop having evidently been improved by the operation and the growth seen from a distance being already indistinguishable from the neighbouring jungle.

Passing along the foot of the Siwaliks eastwards from Bad-shaibagh, through the much overgrazed scrub jungle, which abounds along the edge of the Gangetic plain, the characteristic shrubs and trees of these areas were pointed out to the students. Three species of *Zizyphus*, namely, *Jujuba*, *Oenopia* and *xylopyra*, also *Carissa Carandas*, were specially abundant. In the dry and stony soil of the Raus wherever a slight rise in the bed had left the soil fairly free of large stones, the curious Asclepiad *Orthanthera* was the first and almost the only plant to appear. In such places as had been raised above the level of the stream for a somewhat longer period, a considerable young growth of Khair (*A. Catechu*) was noticed to have sprung up. Associated with this at the sides of the Raus growing on the same poor sandy soil, were found Shisham (*Dalbergia Sissoo*), *Acacia eburnea*, *Mimosa rubicaulis*, and *Odina Wodier*, the Jhingan, the results of the tapping of which latter for resin were very noticeable in the formation, after constant repetition of the operation on the same spots for a number of years, of large lumps or excrescences on the tree.

Rising from the Rau beds to the summits of the hills the following trees were noticed :—*Buchanania latifolia*, Bakli (*Anogeissus latifolia*), Sain (*Terminalia tomentosa*), Khair, Aonla (*Phyllanthus Emblica*), Dhaura (*Lagerstrœmia parviflora*), Salai (*Boswellia thurifera*), *Zizyphus xylopyra*, &c., and uppermost of all the Chir Pine (*Pinus longifolia*). At Barkala very serviceable kind of Forester's quarters have been built. It consists of three rooms with a yard behind. The total cost was only Rs. 560.

The next place of interest visited was the Sahensra coppice. This is an area situated at the southern boundary of the forest on the flat country at the foot of the hills. At its western end it abuts on the Sahensra Rao, and cuttings are travelling in an easterly direction. The coppice was only started in October 1893, and forty acres were laid down as the first year's coupe. These are now being cut over by the purchaser, who has paid Rs 80 for the whole produce. This, as all cutting and extraction are done by the purchaser, represents the net profit accruing to Government. A belt of one chain has been left along the boundary for the sake of protection from the encroachments of animals passing along the road.

Except certain Pipal and large hollow trees, from which shoots are neither expected nor wanted, it is made a rule that all trees must be cut flush with the ground, and to the credit of the contractor it must be said that the work could not possibly have been done better or more thoroughly. The shoots were absolutely

flush with the ground, smoothly cut and domeshaped. The species were :—

Godgudāla (*Sterculia villosa*), Khair, Kharpat (*Garuga pinnata*), Tendu (*Diospyros melanoxylon*), Aonla (*Phyllanthus Emblica*), Kura (*Holarrhena antidysenterica*) Papri, (*Ulmus integrifolia*), Odina Wodier, Bael (*Aegle Marmelos*) *Zizyphus* several species, Salai (*Boswellia thurifera*) &c., &c.

Among these, the best shaped trees, of whatever species, are left as standards. The coppice is made in very inferior scrub jungle, but in the end it will have an extremely beneficial effect by substituting for a crop of crooked misshapen trees, bringing in almost no revenue, a coppice wood of tall shoots suitable for a number of purposes. The rotation will be twenty years, but the Working Plan is not yet completed. The demand at present points to such a rotation for the production of fuel which is being taken to Saharunpur.

On Thursday, January 18, camp was moved to Mohand, and part of the coppice was visited, but at Mohand owing to four days' extremely heavy rain, work was rendered impossible, and the thoroughness of the inspection consequently was in a measure curtailed.

SHORT ACCOUNT OF THE BUDHABAN COPPICE NEAR MOHAND.

The hamlet of Mohand lies at the southern extremity of the pass of that name, and the coppice is on either side of the Saharunpur-Dehra road, in the plain to the south of the village. The area is bounded on the north-east and north by the forest road from Badshaibagh to Hurdwar, on the south-east by the Mohand Rau, on the south-west by a belt of a forest, and on the north-west by the Khajnaor Rau. The coupes are divided by 10 ft. paths; the ground is level, being part of the Ganges plain; and the soil to the north is fairly deep, becoming, however, poorer as we proceed southward. The subsoil consists largely of boulders, and is in great part old river bed. With regard to the growing stock, Sal is fairly abundant in some compartments, chiefly towards the north, the remainder consisting of inferior species. The Working Plan provides that from 75 to 80 acres are to be cut annually. The coupes are numbered from north to south in three parallel rows, so that No. 1 being on the north-east corner, No. 2 is directly to the south of it, and No. 20 occupies the south-west corner of the area. Until last year the coupes were cut up to No. 5 in regular succession, but since the operation of the Working Plan, they are being cut alternately, so that No. 7 will next be exploited. Up to No. 4 inclusive the compartments were cut departmentally. From No. 4 they have been cut by the purchaser. The wood is sold by auction in August, and the purchaser must remove it by March, a month's grace being, however, allowed in cases where the removal was unavoidably delayed.

In No. 4 the standards were very badly marked, the fault of the Range Officer, who had mutilated the trees in the marking, and in that compartment in December last 150 teak and 100 Mohwa with a few Chir pine have been planted in baskets in the blanks, the Chir especially doing very fairly well.

A small table of the yield and the revenue and expenditure is here inserted :—

Compt.	Date of cutting.	Area in acres.	Number of standards left.	Number of trees cut.	Expenditure.	Revenue. (net)
					Rs.	Rs.
{ 1	Nov. 1888	70	926	27,873	264	600
{ 2	" 1889	70	2,448	24,267	252	660
{ 3	" 1890	70	none.	22,323	238	605
{ 4	" 1891	80	1,400	} no record	391	1,000
{ 5	" 1892	75	665		...	630
{ 7	" 1893	75	865		...	535

Nos. 5 and 7 having been cut by purchasers the item of expenditure disappears. In Nos. 1 and 2 in 1893 it became necessary to cut the creepers, which was done by contract at a cost of Rs. 35.

Results of measurements made by students :—

No. of Compt. in which measurement taken.	Date of measurement.	No. of shoots measured.	Av. Ht. in feet.
1	Jan. 1892	274	10'-0"
2	"	281	9'-0"
3	"	581	6'-5"
2	Jan. 1893	940	12'-3"
3	"	849	7'-11½"
3	Jan. 1894	782	9'-5½"
4	"	807	8'-9½"

After two years' growth, the shoots reach such a height that measurement is difficult. It will be noticed from the table that comp. 3, lying as it does to the south, gives poorer results for the same age than either 1, 2 or 4 which lie to the north of it.

On leaving Mohand for Dholkhand a very useful and effective forest bridge made of rough cribwork was shown to the students, and sketches were made and dimensions taken.

IMPROVEMENT FELLINGS IN THE SAHARUNPUR DIVISION.

These have been made over varying areas containing Sal since 1884. The fellings are made primarily with a view to improving the condition of the Sal and Sain found in these areas by removing trees interfering with their growth, and also with a view to getting rid of badly grown and unpromising trees of all species. These are not, however, the sole objects. The operations differ from those being done in the Dún, in that all, or nearly all, the trees cut, are coppiced with a view to obtaining a re-growth in the areas from which the trees are removed. These coppice shoots will not interfere with the trees already on the area, and will in time help to complete the crop, and where this is young, as it very generally is, the coppice will in time give, with the trees left standing, a much more even aged crop than is now on the ground. In Lakarkot the coppice shoots from stools cut in 1885 are now hardly distinguishable from the rest of the crop. Sal poles of a foot in girth and over up to 1 ft. 5 in. are plentiful, and most of them over 30 ft. high. Kokat is also good, and many of both are evidently from pretty old stools. The beneficial effects of these operations were well seen in the Lakarkot block which was visited by the students on the march. The tendency of the fellings is to produce a less pure crop than under the Dun system, and this is a distinct advantage.

In 1892, about 250 acres were gone over in the Dholkhand blocks, climber being cut in the same year. Last year a nearly equal area was cut in the Andheri block, the climbers being cut the previous year. This year 400 acres in Gaj and 200 in Bania-wala are being gone over, 3,945 trees of all sorts having been marked and cut departmentally and sold by auction for Rs. 860. The climbers do not, however, appear to have been cut, which is to be deprecated, as they are rather abundant.

REVENUE SYSTEM FOLLOWED IN THE SAHARANPUR DIVISION.

This was explained at length to the students on their visit to the Mohand revenue chauki on Friday, the 19th January. With regard *first* to the various sources of revenue of the chauki, we have first timber from improvement fellings, *secondly* coppice, and *thirdly* sales of standing trees previously marked up to a paid maximum per block to contractors and others. Villagers may also remove small quantities for personal use, on tickets taken at the chauki. Firewood is sold on tickets taken by purchasers at the revenue chauki, and also is the produce of coppice areas, thinnings and clearings such as lines, roads, &c. Grazing is also permitted on permit, which may be given for one year or for less periods down to a minimum of one month. Some of the grazing dues are realized by the Collector of the District at the various tahsils. Bamboos are worked by a system of blocks which will be explained elsewhere. These blocks are either leased to contractors or are cut

departmentally. Grass and other minor forest produce is removed on contract, a lease for removal being given by blocks from the 1st October to the end of February. This lease may refer to all kinds of grass, fruits, thorns for fencing, fibres from climbers not from trees, &c. Gums and lac are leased separately, as are also honey and wax, horns and hides, and stone for building. Leases are not allowed to be taken on a minor forest produce contract. After the expiration of the leases, that is at the end of February, all the above mentioned produce is sold in small quantities on tickets issued from the chaukis, chiefly to supply the wants of villagers in the neighbourhood. At each revenue chauki there are two Forest Guards (here at Mohand, owing to its extensive business, there is also a Forester) whose duty it is to issue passes, usually up to the hour of 9 A. M., after which time they must patrol, returning in time to check the passes in the evening on the return of the holders. As has before been mentioned, persons wishing to remove, as a rule, small quantities of fuel, &c., are given tickets. These tickets are of six kinds, each kind of a different colour.

Brown tickets,	for the removal of produce, to the
	Do do value of 6 pies
White tickets	Do do value 9 pies
Yellow tickets	Do do value 1 anna
Red tickets	Do do value 2 annas
Blue tickets	Do do value 3 annas
Purple tickets	Do do value 4 annas

These tickets are merely stamped on sheets of paper, sixty-four going to each sheet, and are issued from the Divisional Office at Dehra. The colours of these tickets are annually changed, which system has its disadvantages, as the ability of the buyers to recognize the value of a ticket from its colour is a useful means of proving that the Forest Guard is giving them the value of their money. On the back of the ticket is written twice over, its current number, the date, name and residence of the purchaser, the block for which it is available, and the kind of produce and its value. Half the ticket is torn off when the remover returns from the forest, and these half tickets, together with the revenue collected and the "Chalan" are sent to Dehra. Each pass or ticket issued is entered in a register, and a daily total of those issued is written up in a second register, in which latter are also placed the receipts for tickets sent to the Head Office. An abstract of the second book must be sent in to headquarters every month. Every week the Forest Guard at the Badshaibagh chauki despatches his revenue together with the half-tickets he has collected to the Mohand Office, entering at the same time in a receipt from the amount of his revenue remitted, and the Guards at all the other chaukis do the same. When all have arrived at Mohand the Forester opens all the envelopes, and prepares a treasury receipt form or "Chalan" for

the whole lot, which is then sent with the half-tickets and revenue to Dehra. There the treasury receipt is made out at the Divisional Office in duplicate, one to remain at the Treasury and the other for the Divisional accounts. To persons wishing for a longer currency of permit than one day, which is usually the case for larger amounts of produce than those removed on tickets, passes are given. Passes are made out in triplicate and bear on their reverse sides information identical with that written on the tickets. One copy of the pass remains in the pass books and the second is taken from the remover on his return from the forest, the third remaining with the purchaser just as the half tickets did. The issues of these passes, which are all of the same kind, and the value of which is fixed by the entries made in it only, are also entered in the general register along with the issues of tickets. The counterfoils are treated in the same way as the half-tickets, and the revenue obtained is sent in along with that obtained from the tickets.

THE DHOLKHAND SAMPLE AREAS.

Sample plots are especially useful in India for trees which do not form distinct annual rings. Here the rate of growth must be ascertained by careful periodical measurement of individual trees. Where the factors of the locality differ considerably, the results taken from one sample plot cannot be applied over the whole area of a district, and a different area must be chosen in each different part, from which to draw conclusions. The larger the number of trees in the given area, the more accurate and reliable will be the data yielded. Without knowing approximately the rate of growth of a crop, the compilation of a Working Plan is impossible, as there is no means of forming an idea of the yield. At Dholkhand three areas are set apart in an averagely stocked part of the forest, with a view to ascertaining the rate of growth of Sal in this district. Each plot is surrounded by a trench.

Numbers 1 and 2 are each 200 feet square, the third area is half an acre. The first area was started in 1882, No. 2 in 1888 and No. 3 in 1890. All the trees to be measured are numbered with a small zinc label, and a ring is painted round the tree at about four feet from the ground, at which point all the measurements are taken. Area No. 1 is not thinned. No. 2 was heavily thinned when selected, only the best trees being left, the growth in girth of these being on that account much greater than in No. 1. Area No. 3 was thinned lightly in 1890, only certain trees being reserved for measurement. The growth in girth here may be expected to be more than that No. 1, but sufficient time has not yet elapsed to enable reliable conclusions to be drawn.

The measurements for the past few years have been conducted by the students, and this year the results were as follows:—

Sample plot No. 1:—148 trees gave an average girth increment per tree per annum, calculating for eleven years, of 46 in.

No. 2 :—96 trees for six years gave '74 in. per tree per annum.

No. 3 :—44 trees for four years gave '54 in. per tree per annum.

This last result being probably slightly smaller than the correct one, as the area was first measured in April 1890. The present age of the trees on the area is roughly 20 to 25 years, which estimate of the age is to some extent borne out by history, as the forests of the Saharanpur Division were taken over and fire-protected about 1870.

THE TIRA COPPICE.

On January 26th the camp was moved to Beribara, where the Tira coppice was visited. This area lies to the south of the Badshaibagh, Hardwar road and to the west of the Betban Rau. The coppice consists at present of eleven coupes, which up to the present have been laid out as they were taken in hand. The coupes are all marked off by a ten-foot path. No. 1 is towards the north nearest to the Forest Bungalow, and the area stretches as a long strip to the south of this. The areas are marked by numbered posts at each corner. They are fire-protected and closed to grazing, and three years ago the climbers were cut in coupes 1 and 2. This year the climbers in Nos. 1, 2, 3, and 4 have been cut at a cost of Rs. 10 per coupe of 75 acres. In 1888, the first five compartments were overrun by fire, which, however, did little damage in No. 5, as it was then but just exploited.

The following table shows the financial results of the undertaking :—

No. of coupe.	Area in Acres.	When cut.	No. of Standards left.	Expenditure Rs.	Revenue (net.) Rs.
1	75	1883-84	100	...	40
2	75	1884-85	200	...	145
3	75	1885-86	250	...	305
4	75	1886-87	300	...	400
5	75	1887-88	300	199	620
6	75	1888-89	978	100	420
7	75	1889-90	none	...	265
8	75	1890-91	...	...	300
9	75	1891-92	...	...	400
10	75	1892-93	...	...	380
11	75	1893-94	737	...	410

Nos. 1 to 4 inclusive were cut by contract, but this being found unsatisfactory, the operation in Nos. 5 and 6 was carried out departmentally, after which the coolies having become more skilful, the work was again allowed to be carried out by the contractor who purchased the coupe.

BAMBOOS IN THE SAHARANPUR DIVISION.

Formerly there were 16 blocks in this Division which yielded bamboos, and these were divided into three groups, one containing six blocks and the other two five each. One group was cut over each year, all the culms, which were more than one year old, being cut out and the new ones left. At present, however, they are grouped in the following manner :—

In the Western Range there are two blocks, Mohand and Khajnaor, to be worked departmentally, one each year. In the Central Range there are nine blocks, of which three are worked departmentally, one each year, namely Bam, Sukh and Chillawala. The remainder are leased for working, two in each year, namely Gajand Andheri, Betban and Dholkhand, Golna and Maliwala. In the Eastern Range different conditions prevail. The Maiapur block has to be annually opened to supply the demand of Hardwar pilgrims for holy water baskets, the makers living for the most part at Jwalapur. These men are allowed in on ticket, half the block being opened to them each year. The Ranipur block is worked departmentally every year, and the other three blocks, namely Harnaul, Chirak and Rauli are leased. A few clumps flowered in Ranipur block in 1891-93. The bamboos in Maiapur block, are often solid owing to the poor soil of that block. After cutting, the tops and side branches are taken off and used for fencing, the rest go to Hardwar where they are sold to the pilgrims as walking sticks, for only young bamboos can be used for the baskets previously mentioned. In the Rauli block the bamboos flowered and seeded in 1884-86. Regeneration was not successful owing to constant grazing, consequently only those seedlings which were protected by being under thorny bushes survived. Last year about sixty acres of this block were gone over and the thorny bushes over the young culms were cut back, the effect being markedly beneficial. In the Chirak block, there was a partial seeding which occurred in 1886-87, so that a fair number of clumps dating from that period are seen on the ground, intermixed with much older clumps which have not yet seeded.

With regard to the exploiting of those bamboo clumps, which are being done under departmental supervision, the following facts may be noted :—

The contractor undertakes to cut within one foot of the ground, leaving all bamboos of a year or less, and in cases where there are not enough young ones he leaves a few older ones, so that there should never be less than four in a clump. He is paid at the rate of two or one annas per score according to the

kind of bamboo. All bamboos are brought to the depôt by the rangers house. The kinds of bamboos are as follows :—

1st.—“Chr kalans,” about three inches in girth, all solid, and consisting of the full length of the culm, used for roofing, flags, &c.

2nd.—“Saranchas,” which are larger and hollow, with greater girth than the last, and 10 to 12 feet long, the rest being cut off. These are for splitting for trellis work, baskets, &c.

3rd.—“Bahis,” which may be hollow or not, are rather thicker than Saranchas, and are about seven feet in length. They are used for cots, &c.

The cost of these first three is two annas per score.

4th.—“Chr khurds,” less than “Chr kalans,” otherwise similar, used for roofings, fishing rods, &c.

5th.—“Lathis” about the same as the last, but only five feet long and used for walking sticks.

6th.—“Rakmi bans,” which are the tops of 2, 3 and 5, and are used for fencing, roofing, bottoms of carts, &c.

The first three kinds sell by auction for 6 annas per score ; “Chr khurds” and “Lathis” for four annas, and “Rakmi bans” for three annas per score.

The contractor is also paid at rates varying from one anna to 6 pie per score, according to distance, for the carriage of the bamboos from the jungle to the depôt.

THE RANIPUR COPPICE AREA.

This is very similar in character and management to the rest of the coppice areas in the division. It is bounded on the east by a cut line, on the south by the forest boundary, on the west by the Ranipur Parao and the Rauli block. The area hitherto worked has been gone over from east to west, on the south side of the outer hills of the Siwails.

The crop is somewhat inferior, with a little Sal in places, notably in the small concavities of the hill sides. The most important product is bamboos, which are spread all over the area. The rotation is, as usual, 20 years. The area is fire-protected and closed to grazing, the rest of the forests around being heavily grazed. About 1,180 acres are set aside for coppice, and as yet the coupes are laid out annually as they are cut. Up to 1892, the work was done departmentally, but last year it was placed in the hands of a contractor. The whole Working Circle will consist of seven coupes on the east side of the Rani Rau, which runs through the area, numbers 1 to 4 being on the south face of the outer hills, and 5 to 7 on the north side. Five more coupes will lie between the Rani and Rauli Raes, and eight more between the latter and Chirak. As has been before mentioned, special attention is paid to bamboos and offsets, and seedlings have been freely planted in coupes 3 and 4. Unfortunately, many of the offsets were taken from old clumps, which subsequently fruited, and they have consequently themselves seeded and will die down.

The following is a table of results :—

No. of coupe.	Date of cutting.	Area in acres.	No. of Standards left.	Revenue.	Expenditure.
1	Nov. 88	55	955	215	162
2	" 89	55	850	210	103
3	" 90	40	none	185	160
4	" 91	57	none	241	241
5	" 92	55	400	1,000	500
6	" 93	55	1,327	300	Contractor.

It may here be remarked that in coupes 3, 4 and 5 a certain amount of cultivation was allowed in order to get the ground broken up for planting with teak and bamboo. The teak seed is obtained from the trees on the banks of the Ganges canal. The students spent several days in coppicing in compartment 7, and in cleaning bamboos in compartment 2.

Insect Pests in the Goalpara District.

The year has been rife in insect pests, and vegetation of all descriptions has suffered more or less, though no information has been received about damage done to cereals. From one end of the district to the other, trees exhibit total or partial defoliation, or show their leaves in strips or containing egg cells. In a minor degree the Orthopterous Mantis on *Dalbergia Sissoo*, the Hemipterous Cicada on the long, newly formed blades of *Saccharum* and *Andropogon* and a Coleopterous Chrysophora on *Shorea robusta*, *Careya arborea* and various *Acacias* have done a fair amount of damage. Considerably surpassing this, is the wholesale defoliation of Sal by the Lepidopterous *Dasychira Thwaitesii*, nor has it confined its ravages to this individual tree, but has invaded all the associated species, particularly *Bombax malabaricum*, *Careya arborea* and *Dillenia pentagyna*. Their depredations include lower hill forest, and mixed plain forest, deciduous or evergreen. Small in proportion as the latter class of forest is, confined to narrow margins along banks of streams, it has not escaped the common enemy. The forest growing on an almost laterite clay, that on the richer loam of the submontane regions, that of more recent formation resulting from scourings of disintegrated igneous rocks, or that on the humus-clad surface, with a poor sandy subsoil impregnated with mica, have all suffered in

varying degrees. Pure Sal forest, however, suffered more than mixed, as did forest growing on the lighter poorer soil. The area estimated as affected cannot be less than 800 square miles, and no Sal forest whatever has escaped on the north of the Brahmaputra.

• As far back as 1878, Mr. W. R. Fisher, now at Coopers Hill, reported the defoliation of 200 square miles of Sal forest by this same pest. His description of the caterpillar was not quite correct, as it is covered with long, erect, yellow hairs, with a black transverse stripe, the moth being a fluffy greyish white. It is possible, too, that he underestimated the area affected, as his observations closed early. From information collected and the writer's own observations during the last three years, it may be concluded that this insect, like the poor, is ever with us, but does not seem to have drawn much attention or comment in the interval. On a small scale, it has been known to have attacked tea bushes for years, but has not been looked upon as a very dangerous enemy. Its power for mischief has been miscalculated, however, as the sudden arrest of growth at its most active period of vitality has resulted in the death of a large number of new shoots, tender twigs and branches, and the foliage of many trees present the aspect of a severe burning. In addition to this, a year which opened with the promise of a most abundant seed supply ends with a crop, of which not more than 5% has seeded, the profuse inflorescence having suffered equally with the tender new leaves.

In May and June 1892, a few specimens of these caterpillars were observed, but heavy and continuous rain falling early in the year, possibly interfered with the further development and metamorphosis of the insect. In the following cold weather it was occasionally observed, but at about the close of March no less than 25 square miles were covered, the defoliation being complete. The operations were fragmentary, and of this area not more than 2 square miles were in one block. The insect confined itself to exposed situations, such as demarcated lines, fire lines, roads, &c., and trees growing on the poorest soils. That the affected area was not more extensive may be accounted for by the suggestion made in the Indian Museum notes that the parasites *Chalcis* (*Brachymeria*), *Euploea*, and a species of *Perilampus* destroy the cocoons. The mere firing of the forest did not seem to retard the insect's energies much, as a portion of a Sal area badly burnt in February was not thereby excluded from the insect's favor. It is somewhat difficult to form an opinion regarding reasons for the wholesale appearance of the insect this year, but it is peculiar that like 1891-92, there was little cold weather rain followed by a long drought with very hot weather in the spring. In 1892-93, on the contrary, the rainfall was far above the average, and commenced on an extensive scale in March. It undoubtedly prevented the insect's expansion. The trees which suffered least, as far as seed-bearing is concerned, were the more mature, robust ones.

T. J. CAMPBELL.

Yield of Katha.

I had intended writing for our Journal a detailed account of the method of manufacture as practised here, in the Province of Gujrát, of *Acacia Catechu* wood extract (*Katha*, not cutch), but the necessary leisure has always failed me. As I start for Europe in a few days on two years' furlough, and my notes are likely to get mislaid in that time, I think I ought to send you at once a few figures obtained from my experiments.

6,335 lbs. of wood chips yielded 3,351 lbs. of moist katha, the weight of which when completely air-dried was 410 lbs., an out-turn of 6.46 per cent. By moist katha I mean the soft precipitate, which is moulded with the fingers of one hand into small cones and put out thus to dry in the shade. To produce the above quantity of katha, 80 men and women were employed during 4 days, and 40 earthen fire-ranges, in the form of small tunnels, and having two parallel lines of three openings each in the roof for the boiling pots, were kept going from early morning until night fall. The cones were dry enough for the market about 3 weeks after the chips had been boiled.

The price of katha has been steadily rising, and I could sell in a single year all the extensive *Acacia catechu* areas of the Baroda State to the katha boiler. Last year the price of katha was Rs. 45 per 100 lbs. at the place of manufacture. In my experiment, which was possible through the kindness of the State lessee, the cost to that individual of 100 lbs. of katha was, leaving out annas and pies, Rs. 27, of which Rs. 8-8 went into the State treasury as royalty, and Rs. 18-8 to the labourers. From the balance of Rs. 18 per 100 lbs. must be deduced expenses for management, cost of journeys, pots, axes, &c., before we arrive at the profits of the lessee, which, however, do not average less than 20 per cent. on total outlay.

In this province of Gujrát, katha boiling is confined to a single aboriginal tribe, which calls itself Kathorias, from the name of their business. As a rule, they are fed and clothed (?) by the lessee, receiving a small money wage in addition calculated on the number of fire-ranges, which is also the basis for reckoning the amount of royalty.

I am glad that the Reporter on Economic Products to the Government of India has issued a separate corrected article on the manufacture of katha, for the original article in the Dictionary was a curious mixture of fact and garble, due to the authorities drawn upon having been quoted wholesale without the necessary sifting.

In sending to the Forest School last year, specimens illustrating Katha boiling in Gujrát, I suggested that it would be interesting to find out with the help of the Forest School Chemical Laboratory whether any proportion of catechin or tannic acid

still remained in the boiled wood-chips. It would also be useful as well as interesting to ascertain whether the yield of 6·46 per cent. of Katha was the maximum obtainable from the wood used ; also what difference in the proportion of catechin and tannic acid exists between Gujrat Katha and that manufactured in Oudh and Kumaon.

CAMP *viâ* BARODA, }
29th May, 1894 }

E. E. FERNANDEZ.

Experiments on the Calorific power of Woods.

We have received from the Inspector General of Forests, for publication, a copy of the correspondence relating to the experiments made in the Agricultural Chemist's Laboratory in Dehra on this subject. The following were the woods experimented on :—

Sal,	<i>Shorea robusta</i> ,	}	From the Dehra Dun Forests
Sain,	<i>Terminalia tomentosa</i> ,		
Jaman,	<i>Eugenia Jambolana</i> ,		
Dhaura,	<i>Lagerströmia parviflora</i> ,		
Safed Siris,	<i>Albizzia procera</i> ,		
Kharshu	<i>Quercus semecarpifolia</i> ,	}	From the hill forests of Jaunsar.
Moru,	„ <i>dilatata</i> ,		
Ban,	„ <i>incana</i> ,		
Chir,	<i>Pinus longifolia</i> ,		
Kail,	<i>Pinus excelsa</i> ,		
Rai,	<i>Abies Smithiana</i> ,		
Morinda	„ <i>Webbiana</i> ,		

A specimen of surface coal from the Dun, found in the School Museum, was also analysed. The calorific power of pine wood was the greatest of all the specimens tried. Then came the firs, then the oaks, then Sal and the plains trees, the last being Dhaura.

In regard to the Dun woods Dr. Leather wrote :—

“ I have the honour to forward you the results of my determinations of the calorific power of the five samples of charcoal and of the sample of coal sent to me for that purpose.

“ 2. As will be seen from the figures appended (“ evaporative power ” of the the five samples of charcoal) the variation is not great, the lowest value being 12·34 for Dhaura, and the highest 13·32 for Sal. Sain charcoal seems to contain a considerable amount of “ ash,” *i.e.*, mineral matters, and this *might* prove a disadvantage, if the charcoal were employed in a furnace. The point could, however, only be determined from working on the manufacturing scale.

“ 3. The coal has a very much lower evaporative power than the charcoals:—

	CHARCOAL.					COAL.
	Sal.	Sain.	Jaman.	Dhaura.	Safed Siris.	Dehra Dun Coal.
Moisture ...	5·75	7·42	7·26	10·95	6·84	3·75
Carbon & other organic matters ...	91·10	83·66	89·66	86·15	89·56	
Ash ...	3·15	8·92	3·08	2·90	3·60	6·95
	100·00	100·00	100·00	100·00	100·00	
Calorific power (pure c=100) ...	88·80	84·90	85·40	82·30	86·90	78·90
Evaporative power... (—lbs. of water at 212°F evaporated by 1 lb. fuel.	13·32	12·73	12·81	12·34	13·04	10·54

And in respect to those of Jaunsar, he reported:—

"I have the honour to submit herewith the results of the determinations of calorific power and the analysis of the seven samples of charcoal handed to the Assistant Agricultural Chemist in December, 1893."

CHARCOAL.

		Khar-shu.	Moru.	Ban.	Chir.	Kail.	Rai.	Morinda.
Moisture	...	5.85	2.35	4.75	4.15	2.55	4.35	2.15
Carbon, &c.	...	92.05	92.10	91.30	94.65	97.10	90.80	96.80
Ash	...	2.10	5.55	3.95	1.20	0.35	4.85	1.05
		100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calorific power pure carbon—100	...	93.08	91.23	90.77	97.85	96.92	93.85	95.38
Evaporative power—lbs. of water at 212°F evaporated by 1 lb. fuel.	...	13.96	13.68	13.62	14.78	14.56	14.08	14.30

New Works on Forest Law and on Land Revenue Systems.

Mr. B. H. Baden-Powell has added to his many services to the Indian Forest Department and to Forestry in general, by writing an excellent treatise on *Forest Law* (1), unique in the English language, and which will be a standard of reference for the United States of America, and all British colonies, as well as for the British Isles, whenever these countries perceive the necessity for a proper organization of their forests, and wish to follow the example of India as well as of France, Germany and other European countries which have had recourse to forest legislation.

No one could be more thoroughly qualified for the above work than Mr. Baden-Powell. A member of the Bengal Civil Service, he was Conservator of Forests in the Punjab from 1869 to 1880, and from 1872 to 1874 he acted as Inspector-General of Forests, during Sir D. Brandis' absence on leave. He also assisted in drafting the Bill, which subsequently became the Forest Act of 1878, and he drafted the Forest Act of Burma (1881). In 1872 he was sent by the Government of India to Burma to investigate the extensive frauds in the teak timber trade. He left the Indian Forest Department in 1880 on being appointed Officiating Commissioner of Umballa, and he was afterwards raised to the Punjab Chief Court, which position he resigned in 1889 on his retirement on pension. His services to forestry have, however, never ceased, as he gave a course of lectures in Forest Law at the Dehra Dun Forest School in 1881 and every year since 1892, he has given a similar course of lectures to the

(1.) "*Forest Law.*" A course of lectures on Civil and Criminal Law and the law of the Forest (chiefly based on laws in force in British India), by B. H. Baden-Powell, C. I. E., London. Bradbury and Co., Bouverie St. 1893.

Coopers Hill forest students which indeed form the subject of the present book. Mr. Baden-Powell has thus had great experience in the control and working of Indian Forests, besides possessing a most complete and practical legal training, and one of the many benefits for which India has to thank Sir D. Brandis, is that owing to his tact and good judgement, the initiation of the forest legislation in India, and the instruction of the Indian forest staff in the subject, has been placed in such capable hands.

The present octavo volume of 500 pages is intended to replace Mr. Baden-Powell's '*Manual of Forest Jurisprudence*' of 1882, which is out of print, and the subject is now brought up to date, and considerably improved in arrangement and matter. The sketch of Indian Civil Procedure and of the Stamp and Registration Laws which were included in the former work, have now been omitted. The book is divided into 3 parts, each comprising a number of lectures.

Part I gives elementary notions of Civil Law, and in it lecture No. 1 is introductory to the subject. Lectures 2, 3 and 4 are on the *Law of Persons and Things*, and lectures 5 and 6 on the *Rights of Persons over Things*, including an account of *Mortgage, Easements and Servitudes*, a detailed knowledge of the latter being so important in forestry.

Part II deals with the *Indian Criminal Law*, including that of *Procedure*, in lectures 7 to 13.

Part III deals with the *Forest Law*, lecture 14 explaining the reasons for a special forest law, and the *topics* it deals with; describing the various Acts and Regulations passed in India, with the exception only of the recent '*Assam Regulation*', which was probably received too late; and giving an account of the Rules which are made under the Acts. Lecture 15 is on State property, and gives an account of the state of the law regarding the right of the State to all waste lands not lawfully occupied; and of the classes of public and acquired property. Lecture 16 explains what lands are subject to the forest law. The important statement is here made that the term *protected forests* was only suggested in the Draft Bill prepared for the Forest Act of 1878 as a temporary expedient, for the framers of the Act considered it impossible to take all State waste land in hand at once and deal with it as Reserved Forests, which entailed a complete enquiry into, and final settlement of, all rights over any forest in question. Their views were unfortunately not accepted, and a class of *protected forests*, not properly or permanently secured, was founded by the Indian Legislature. At the end of this lecture is a valuable Appendix, with a *resumé* of the European law in different countries regarding the control by the State of communal forests and forests belonging to corporate bodies and institutions. Lecture 17 gives the legal steps to be taken in the constitution of forest estates, and lectures 18 to 22 explain forest easements, and how they

may be regulated, or extinguished. An Appendix to Lecture 22 gives an "Abstract of the German Law regarding Regulation and Extinction by Compensation of Forest rights," which is most interesting and deserves careful study, especially in view of cases which may very well occur in parts of India in which the growth of rights, or of privileges amounting to rights, makes their extinction by purchase a necessity if the area concerned is to be maintained at all as a forest estate. Lectures 23 to 25 are of the legal protection of forests and their produce in transit, and the two final lectures 26 and 27 on the legal organization of the Forest Service. We have here a complete and well arranged scheme dealing most thoroughly with forest law, and greatly facilitating its study and practice in India.

The 2nd book before us is a neat little volume in 260 pages with a map of India, showing the areas under the different kinds of land revenue settlements. Mr. Baden-Powell's '*Land systems of British India*' (2) in three large volumes is really intended to act as a Gazetteer for all the provinces in British India, the land systems in each of which are dealt with separately. The present volume gives sufficient practical information to serve as a text book for Forest Officers and others outside the land-revenue department. It consists of two parts: part I, in 5 chapters, gives a general explanation of the Land Revenue of India, including notes on the features of the country, climate and other matters affecting the land revenue administration; the organization of the provinces and districts with reference to it, and finally what lands are liable to pay land revenue, and the rules for the disposal of waste lands.

Part II gives an account of the different tenures of land in British India and the land-revenue systems, including the different settlements with landlords, villagers, or farmers (raiya) which prevail in different parts of India. The old land revenue was taken in kind on the threshing floor by the Mogul's agents to the extent of one-third, or half, the grain. This payment in kind was afterwards commuted into a money payment, the principle being to take as much as the farmer could stand without being actually rendered a pauper, and unable to cultivate for another year. The British attempts at the settlement of the land revenue are all well described, the permanent settlement of Bengal and Northern Madras, the raiyatwari settlements of Madras and Bombay and the village settlements in Northern India, which are subject to revision every twenty years. The difficulties of the revision which might last four or five years, and upset all the country side, are fully explained, and also the present way of keeping a careful record by means of village officials of all the data of production, and all changes in land ownership which occur, so that land revenue records are always up to date, and a

2. "*Land Revenue in British India*." By the same. Oxford, Clarendon Press 1894.

revision can be carried out with the minimum of trouble. Curiously enough, Mr. Baden-Powell states (page 50) that land permanently settled is not more valuable, and does not sell for more than land subject to revision of settlement, a strange comment on the folly of the permanent settlement, which forfeited so much national wealth for the profit of the Bengal and Northern Madras land-owners, who after all were originally mere revenue agents.

As regards the proposed cadastral survey of Bihar, so desirable for obtaining useful agricultural statistics and for guiding the action of Government in case of famine, and for protecting the rights of the raiyat, Mr. Baden-Powell thoroughly justifies this measure, and states that the objections to it really rest on the old world relations of Zamindar and Raiyat, under which everything was in the loose and unordered condition dear to oriental managers. The zamindar was then able to do what he liked, and to be absolute master, while the peasant was his slave.

After carefully reading this treatise on the Land Revenue of India, it may be confidently recommended as a most concise and clear account of a very intricate subject.

VI.—EXTRACTS, NOTES AND QUERIES.

Afforestation in the British Isles.

The question of extending the woods of the United Kingdom has recently been brought forward in the Press, and questions have been asked in Parliament as to the willingness of Government to assist in furthering a scheme for stocking certain of our waste lands with trees. Now afforestation may be required owing to those indirect advantages it affords to the climate and soil of a country, which have been described in detail by Dr. Schlich, and again quite recently in Nature, by Dr. Nisbet, or merely to increase the national wealth in forest produce. In our case, forests are certainly not required merely to reduce the air and soil temperatures, or to increase the atmospheric humidity; they may afford useful shelter against the strong westerly gales, or cutting east winds, and in our more mountainous districts they may assist in preventing denudation of the soil, which on a large scale has proved so destructive to agriculture in the Rhone Valley and other regions, but is not very much to be feared in our islands.

The chief use of forests with us is, therefore, for our timber supply, and to render us more independent than at present of imports of this valuable and bulky material, the inland transport of which is so costly. Our mild moist climate is admirably adapted for producing oak, ash, beech, and other broad-leaved timber, as well as larch, silver fir, Scotch pine and spruce; and were the land stocked with trees whenever experience shows that it cannot be profitably used for agriculture, our wealth would be considerably increased, and so would be the demands for agricultural labour.

Exclusive of an import of £3,000,000 worth of teak, mahogany and other tropical woods, which we cannot grow ourselves, we also import annually £12,000,000 worth of oak, ash, and coniferous timber, all of which we might grow at home. Dr. Schlich has estimated that if 6,000,000 acres of our waste lands were planted they would eventually yield sufficient timber to render these latter imports unnecessary. It is even probable that a smaller area would suffice, were the productiveness of our existing woodlands increased by better management.

This extension and improvement of our woodlands is the more urgent, as the forests of Canada, Scandinavia and Russia, from whence most of our timber imports come, are not sufficiently well managed to secure the production of a steady supply of timber for export. The markets for their timber are also extending in France, Italy, the Netherlands, the United States, South Africa and other insufficiently wooded countries. The following table, comparing the ratio of the woodland area in 1892 of our own and

other European countries, with their total area, places us at the bottom of the list:—

Name of country.	Area of forests per 1,000 acres.	REMARKS.
	Acres	
Austria-Hungary ...	343	{ Area of forests less by 102,000 acres since 1872
Russia ...	342	
Germany ...	257	
Sweden and Norway ...	250	
France ...	159	{ Countries importing more timber than they export
Italy ...	145	
Belgium ...	143	
Holland ...	72	
Denmark ...	60	
British Isles ...	39	

If our present area of woodlands, 3,000,000 acres, were increased by 6,000,000 acres, as proposed by Dr. Schlich, we should still have only 117 acres of woodland per 1,000 acres total area, and should stand between Belgium and Holland on the list.

These 6,000,000 acres would chiefly be taken from our unenclosed mountain and heather land, which, in the agricultural returns for 1892, is given as 12,117,000 acres for Great Britain, figures for Ireland apparently not being available. But as in 1880 there were $4\frac{1}{2}$ million acres of waste land in Ireland, it is probably within the mark to estimate the total area of unenclosed mountain and heather land for the United Kingdom at 15 million acres.

Much of this land is at present used for pasturing sheep, and leased in the Highlands of Scotland at from one to four shillings an acre, according to quality. Large areas of it are also let as deer forests; the rent being fixed at about £25 for each stag which may be shot; and as 2,500 acres will support about 25 deer, five only of which are mature stags, the rent of average deer forests, exclusive of the buildings on them, cannot be more than one shilling an acre. It is the poorer lands at high altitudes, where sheep pasture does not pay, which are generally let as deer forests.

The cost of planting or sowing varies considerably according to circumstances, and is given in Brown's "Forester" (1882) as varying between £3 and £10 an acre, according to the nature of the fencing and draining required, which are the chief items. In calculating the returns from a plantation, the initial cost of planting must be reckoned at $2\frac{1}{2}$ per cent. compound interest up to the date of felling, and this sum deducted from the proceeds of the felling. Any intermediate proceeds from thinnings will of course be added with interest allowed up to the date of the final felling.

Before a land-owner would venture to plant his land on a large scale, he would have to answer the following questions :—

Is the land suitable for the successful growth of any particular forest species, and if so, what are these species, and how should they be grown? Will the sale of the timber be more profitable than the present rent of the land? As a rule, most of these rough pasture lands, except in their moister depressions, are only fit for conifers, and in many cases only for Scotch pine. A large part of the area also is at present stocked with game, and although forest growth may be compatible with pheasants, black game, capercaillie, or a moderate number of deer, it certainly cannot be expected to thrive where rabbits abound; so that the value of the land as a game-preserve will also intervene.

Experiments might certainly be made to plant up the extensive tracts in the Midlands and elsewhere, which are now encumbered with shale and slag from abandoned ironworks, and which may be bought for an old song. Ash and maple grow well on heaps of slag in the Ardennes, and these species, and probably some others, might certainly be planted on similar areas in our black country. It is true that the cultivation of trees will not prosper within a certain distance from factory chimneys belching out sulphurous and other noxious fumes, but means may be adopted to fix the sulphur within the factory, and to prevent the air from being contaminated; whilst much of the shale and slag is already sufficiently distant from the obnoxious chimneys.

As regards the increased demands which an extended area of woodlands would afford to labour, Dr. Schlich has calculated that if 6,000,000 acres of our waste lands were planted up at the rate of 300,000 acres a year, this would employ annually some 15,000 labourers, and that eventually, once the forests had been grown, about 100,000 labourers would find in them steady employment, besides the large number of hands required by the special forest industries which this large forest area would certainly call into existence.

Such an industry already exists in the chairmaking business of Buckinghamshire. The forests on the Chiltern Hills supply thousands of people with beech-wood, 500,000 cubic feet of which are worked up annually into chairs in the town of High Wycombe and the surrounding villages. Some of these beech forests are getting thin and unproductive, owing to excessive felling and other bad management; but wherever a moderate amount of care is taken not to overcut the woods, as much as 20s. an acre per annum is obtained, without any expenses for planting, as the beech reproduces itself naturally. The poor dry soil above the chalk, on which the beech thrives, would, if the forest were rooted up and the soil limed at considerable expense, only yield a rental of 12s. an acre as farm-land. Evidently here we have a district where forestry is more productive than agriculture, and where planting

might be extended ; and the same may be said of the large area of heather land above the Bagshot Sands in Surrey, Berkshire, Hampshire, which might all be stocked with conifers were sensible measures adopted to stop the progress of the annual heath fires.

When it is remembered that we import 70,000 tons of pit-props every year, chiefly from the cluster pine forests near Bordeaux, and that in the Belgian Ardennes, at a distance of 80 miles from the coal mines, 40 year old Scotch pine, used for pit-wood, can be sold standing for £55 per acre, exclusive of the value of thinnings, which would pay for the cost of producing and tending the forests, and this means an annual profit of 16s. an acre, including an allowance for compound interest at 3 per cent., there can be no reason why we should not grow our own pit-props on waste land unsuitable for agriculture.

Many farms on heavy land are at present either going out of cultivation or paying very badly, and as an example of the successful forest treatment of similar land on the London clay, the Princes Coverts, near Esher, in Surrey, may be cited.

Leopold of Saxe Coburg, the consort of our Princess Charlotte, and afterwards king of the Belgians, about seventy years ago united several small woodland areas, by planting up the land of two farms, in which they were situated, with hazel and ash coppice and oak standards. The present extent of the coverts is 868 acres, and their yield, after deducting all costs of management, amounts to at least 16s. an acre per annum, and probably more ; but Messrs. Clutton, the agents of the Crown lands, in which these woods are at present included, might supply the correct figures. The coppice is felled every ten years, and yields supports for fruit and ornamental trees, bean and pea-sticks, clothes, props, kindling fuel, &c., which are largely in demand for gardens, orchards, and laundries around London ; while the oaks, which in seventy years attain a girth of about five feet, are readily sold standing at 1s. 6d. and 2s. a cubic foot, according to quality.

Whilst, however, the work of planting up our waste lands must necessarily be chiefly left to private agency, the State should bring the Crown forests into a high state of productiveness, and render them examples of good forest management. Forestry is eminently a practical business, and when a land-owner wishes to plant, he should be able to see the ideal way of dealing with different localities on economic principles in our Crown forests. This at present is far from being the case. Very large sums of public money were spent in planting up the Crown forests in 1813-25, when there was a fear of our running short of timber for the Navy. It is true that our Navy now depends on teak and iron, rather than on oak and pine ; but oak and pine are still valuable commodities, and the present condition of the Crown plantations, made about seventy-five years ago, is certainly not satisfactory, owing to the want of underwood, and the excessive nature

of the thinnings to which they have been subjected. Over an extensive area in the New Forest the Scotch pine mosses have been allowed to outgrow the oaks they were intended to shelter temporarily. The fact is, a forester is wanted at the head of our Crown forests, who will see among other things, that they are properly underplanted, and that all blanks are restocked ; but in order to do this successfully, the rabbits, which now swarm in some of the woods, must be kept down. This was not the case twenty years ago ; but their increase of late has been prodigious, and they not only eat every natural seedling which appears, but also threaten the existence of the older trees by barking them in the winter.

It should be noted that the Crown forests are managed by the State, and their proceeds go into the Treasury, but that the sporting rights in some of them are vested in the Crown. Surely the Royal sportsmen might be contented with a moderate number of rabbits, and with pheasants which do no injury to the woods, and not require the enormous multiplication of rabbits, which no continental prince would suffer in his forests.

It may be objected that by treating our Crown forests for economic forestry, as is the case with the Crown woodlands in other European countries, we should introduce uniformity, and spoil much of their picturesqueness. There are, however, 5,000 acres in Epping Forest, 4,000 in Windsor Park, and extensive tracts in the New Forest, which might be reserved for the lovers of the picturesque, and even then 100,000 acres might be found in the Crown forests which could be made into models of good forest management, which are at present not to be found anywhere in Britain.

W. R. FISHER.

(In '*Nature*' for April 26th 1894.)

The Planting of waste and unproductive Moorlands . in the Highlands.

(From the *Scotsman*.)

To how many of those who know our Scottish Highlands does it occur that those miles and miles of heather, characteristic of our scenery, may not be a natural growth, but, on the contrary, the product of a rude cultivation? Immense tracts in North-Western Europe, once known to have been densely wooded, are now covered with a vegetation in which heather predominates, and though most of us know that in the history of every country man at one time or another destroyed a greater part of its forests, few consider that it is only by continual effort that a forest vegetation is prevented from again taking possession of the soil. Let but nature have her own way with a bit of moorland—she may take ten

or twenty years or much longer to do it, depending on the distance from a forest, character of the soil, and other circumstances—sooner or later there will be found a few firs struggling to gain the ascendancy; a few birch, willow, and aspen seedlings scattered amongst the heather. In short, the bit of moorland is becoming a wood. But by periodical burning, the grazing of cattle and sheep, and overstocking with game, all promise of a future forest is choked at its birth. Considering the needs of the present day, are we affecting the balance of nature to our advantage? Competent authorities declared that were nature given a free hand those immense tracts of heather in the north-west of Germany would in time be again clothed with forest. Too much practical value, however, does not attach to the fact, and so there, and in many other parts of the Continent, the forester comes to the assistance of nature, and yearly claims large areas for his operations. What answer should we in Scotland give to the question—Would it be wise to plant on a large scale our waste and unproductive moorlands? The science of forestry has in this country within the last few years made some progress towards attracting the public interest due to it; and, since the subject has lately been mentioned in Parliament, not a few may have sought an answer to such a question. It may be useful, then, to present some arguments of general interest for and against the planting of our heather-clad moors and hillsides.

The private individual will probably first ask, Will it pay? Taking into account cost of planting, rent of land, and so forth, shall I receive a sufficient return in hard cash? This is a most difficult question, and one only to be answered in specific cases. A man who is willing to spend money on the afforestation of waste lands must remember that money thus spent accumulates with compound interest to a large sum in 80 to 100 years, before which time, except in the case of copsewood, he cannot reap his harvest. The result, indeed, often proves that the ultimate profit would have been greater had he received a small annual rent for the land, say for sheep grazing. The very fact that he is making a sacrifice for the benefit of others, that during his lifetime he can hope for no pecuniary return, prevents many a landed proprietor from considering the matter at all. Woods are, however, planted, and where they already exist, preserved, with other objects in view than a mere direct return in money. The beneficial effects of forests on climate—conservation of moisture chiefly—are well-known. Then, in the case of steep mountain sides, the heavy rainfall which on a bare slope would rush down, carrying the soil with it, and swelling the rivers into sudden flood, will, where the slope is covered with forest, disappear in its carpet of moss, leaves, and humus, which, like a huge sponge absorbing many times its own weight in water, forms a reservoir feeding surely and regularly spring and rivulet. In the high Alps a

forest hinders the formation of the dreaded avalanche, and on the coasts of France and Germany the serviceable fir binds the drifting sand. Forests also afford a capital cover to all kinds of game, and what is of great importance in our time, they gave directly and indirectly employment to a considerable population. For these and many other reasons forests are important in the economy of nature and of society. But in favoured Scotland, although her forests are few, the climate, as regards moisture, leave nothing to be desired; the rivers do not in spring come down in disastrous floods, to be dried up for the rest of the year; no avalanches carry death and ruin down the sides of Ben Nevis or Ben Cruachan; nor are there on our coasts thriving villages and prosperous towns in danger of being engulfed by driftsand; it almost seems as if the grounds urged for afforestation in other countries could have no weight with us. Still it would be wrong to suppose that no arguments remained in favour of planting the waste land of this country. There can be no doubt that forests play an important part in improving the soil. They would also add much to the beauty of our scenery, besides affording shelter to various kinds of game. Red deer, it is true, prefer the solitude of corrie and glen to patches of woodland, where they do not feel secure; but the forests, broken only by a few open glades and cultivated clearings, was once their home. Grouse would probably always keep to the open moors, but with roe deer, capercailzie, black game, hares, and rabbits, it is otherwise. Roe deer and capercailzie are no great friends of the forester, but the damage done by them is only serious in the case of small detached plantations. In many well-wooded parts of the Continent both are numerous, yet few complaints are made. Rabbits alone are an unmitigated nuisance, and their numbers must be kept within reasonable limits. At a time when much is heard of the depopulation of the highlands, it is important to remember that the afforestation on a large scale of our waste and unproductive moorlands would now permanently give employment to a large proportion of our crofter population. In winter, when others find work scarce, the woodcutter is fully employed. In spring the work of sowing and planting may largely be entrusted to women and boys. In summer the men can employ their spare time in mending the roads in the forest, putting up fences, and other odd jobs; while in autumn little or no work need be done in the woods, all hands being busy at the harvest. Many of us who have been on the Continent have seen in the Harz mountain, Bavarian Alps, and elsewhere, happy and prosperous villages, the existence of whose inhabitants, the soil fit for the plough being scarce, depends on the employment they find in the surrounding forests. Is there a village in all Scotland where the inhabitants depend on the surrounding grouse moors and deer forests for their existence?

The crofters are in urgent need of some employment to enable them to better their condition: still it would in most cases be unreasonable to expect the private individual who receives a high annual rent for the grouse shooting on his moors to drive away this game planting, thus giving up his certain income for the sake of a mere speculation. If anything of importance is to be done, it must be by means of a Government scheme. Present sacrifices may be necessary, but such a scheme will prove remunerative, provided the operations be conducted on a large scale, and the education and experience of the foresters be such as to ensure that the initial expenses shall be as small as possible, and the result show a crop of valuable timber. Not another country in Europe offers so favourable a field for the operations of afforestation. Seeing it is by no means certain that the countries from which we now draw our timber supplies may not become, at least in part, exhausted, it is high time we gave the matter our earnest consideration. All are agreed that timber can be grown in Scotland as good as any imported; let us hope the day is coming when home requirements will largely be satisfied by home-grown timber.—(*Timber Trades Journal*.)

The Utilisation of waste wood and Sawdust.

The numerous saw-mills and wood-working machines used in the colonies, and in large timber-growing countries generally, find, not infrequently, that there is a difficulty in the disposal of their waste wood and sawdust. In a few large wood-working establishments at home, enterprising proprietors have set up chemical apparatus for utilising these products, and recently Mr. W. Hadfield-Bowers, Brookfield Chemical Works, West Gorton, near Manchester, has introduced a machine for this special purpose. It is known as the "Bowers" Patent Retort and Drying Oven, and has been in use for nearly a year, doing all that is claimed for it in recovering useful products from waste wood and sawdust. The case with which the apparatus can be set up and manipulated should be an important factor in recommending it to the use of saw-mill owners and wood-working factories abroad. It consists of an iron chamber pierced by a central flue which divides the chamber into two divisions, an upper and a lower. The fire under the bottom plate heats the lower chamber; the waste heat from the lower chamber passes through the central flue and heats the top chamber. The wood or sawdust to be dried or carbonised is fed into a hopper from which it passes automatically to the bottom part of the upper chamber, where it is moved forward by a pair of endless chains carrying bars to the end of the chamber, where the materials fall upon the bed of a lower

chamber, and are slowly conveyed towards the fire end. The chambers are so arranged that there cannot be any escape of vapour; and thus all the pyroligneous products in the drying process are condensed and collected. The apparatus can then be used for thoroughly carbonising the spent material, as well as for the ordinary drying of such substances as spent dye-woods, tanning materials, fossil meal, brewers' grains, &c.—(*Timber Trades Journal*.)

To make the Black Country Green.

A very interesting social experiment has just been conducted by Mr. Fisher, the Assistant Professor of Forestry at Cooper's Hill. Mr. Fisher has inspected a considerable area of what is to outward view the most hideous and forsaken district in England—the Black Country. The soil is covered with the wreckage of abandoned coalpits. The rush of men too hasty to be rich has passed over its acres, and left them black, bare, apparently sterile. But Mr. Fisher is convinced that one or two hardy specimens of trees would flourish there, and that a careful experiment in planting would turn the country green again. The trial would not be costly one. Will not the Government (asks the *Chronicle*), or, failing them, some disciple of Mr. Ruskin, help to recolour at least a few hundred acres of the Black Country?—(*Extract*).

The growth of Trees.

The editor of the U. S. *Monthly Weather Review* comments on a series of measurements of the growth of trees, made by Mr. J. Keuchler, of Gillespie County, Texas, about two hundred miles north-west from the Gulf Coast at Indianola. Mr. Keuchler seems to have adopted the idea that a tree bears the history of its climatic surroundings written in itself, and that its annual rings of growth vary in size mainly with the supply of water to the roots, so that broad rings indicate wet years, and thin rings that can scarcely be distinguished with the naked eye denote dry years. After carefully selecting trees for his measurements, he felled three oaks, two of which were over 130 years old. He cut a perpendicular section from each trunk near the thick end, planed its surface very smooth, and then varnished it over which made the annual rings distinctly visible. From each section a table was prepared of the relative order and position of the annual rings; upon comparing these three tables they were found to correspond exactly, thus indicating that moisture is the principal cause of the difference in the breadth of the rings. Taking

the width of the respective rings as a criterion of moisture the record of 134 years shows six years extremely dry, eight very dry; 19 dry; 17 average; 18 wet; 60 very wet; six extremely wet. The editor of the *Review* points out that the large number of very wet years is not at all in accord with the rainfall records during the years 1840 to 1890, and, in fact, no region on the globe is known where the distribution of the rainfall is similar to that given by these records. It is evident, therefore, that the breadth of the annual rings of growth adopted by Mr. Keuchler as corresponding to dry and average and wet seasons needs considerable modification. The width of the annual rings depend, at least in part, upon evaporation, the sunshine, the temperature, and the distribution of rain in frequent showers or in frequent heavy floods. It is the combination of several favourable meteorological circumstances that must have produced the large number of broad rings which Mr. Keuchler has attributed to 60 very wet years and six other extremely wet years. In fact it is best not to attempt to establish any fine details as to the climate from such a record of tree growth, but to be content with the general statement that there were 14 years during which the climate was unfavourable for the increase of woody fibre, 54 years during which there was an average favourability, and 66 years that produced large growth owing to very favourable conditions. All that can safely be concluded is that during 134 years there were 66 in which the rainfall was well conserved for the use of the tree.—(*Indian Agriculturist*.)

Seeding of Forest Trees.

Mr. G. A. Richardson, Divisional Forest Officer of Buxa, Bengal, writes that the present is a good seed year for Sal. Mr. Nallasawmy Naidu, Divisional Forest Officer of Bellary writes that in 1893-94 *Acacia arabica*, *A. leucophloea*, and the tamarind seeded profusely. This year *Hardwickia binata*, *Bassia latifolia* and *Diospyros Melanoxylon* are expected to seed abundantly.

In the hills of Jaunsar an abundant crop of deodar seed may be expected in the autumn, and the *Pinus excelsa* is also likely to produce well. The 'Ktarshu' Oak (*Quercus semecarpifolia*) has already shed its acorns, many of them actually in germination before falling from the tree.

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A Note on the Propagation of Blackwood or Roseweed

(*Dalbergia latifolia*)

IN JAVA.

BY S. H. KOORDERS.

(Translated from the German.)

On one of ridges of the low chain of hills, which intersects the district of Banjumas, in a locality called Gunung-Bantu, may be observed a small plantation of *Dalbergia latifolia*, known to the inhabitants as the Sono-Kling tree. This plantation is situated at about 250 metres above sea level, and consists of only a few hundred trees, which were planted in 1875-1876 by the State Forest Department. When I visited the spot in 1891, I observed that the trees were from 15 to 22 metres in height, and that every one of the trees originally planted was surrounded by a thicket of young stems of the same species. This young growth consisted, not of seedlings, but of root-suckers, and some of these root shoots had already attained a height of 9 metres, and were themselves propagating other suckers from their root system. It appeared to me that a more accurate knowledge of this peculiarity in the propagation of such a valuable tree would be most desirable, and I propose to communicate in this article the results of the observations made. I commenced by selecting one of the original 16-year-old trees, which possessed an unusually large number of root-shoots. The tree stood, as has before been noted, on a ridge some 750 metres above sea level; the soil was a stiff reddish-brown clay which becomes very dry and full of splits and cracks during the dry season, and yields, according to the statement of the inhabitants, only very poor crops. From the above description the discovery of a stratum of hard ironstone, at a depth of a few decimetres from the surface, will not be wondered at.

The selected tree was about $15\frac{1}{2}$ metres high, with a diameter at breast height of about 0.60 metres. The stem was irregularly cylindrical, and was straight for about two metres, when it separated into four main branches, which formed a very dense crown covered with dark green leaves. This crown had a diameter of about 12 metres, and was shaped like a somewhat flattened sphere. The outside bark was dark grey brown in color; the sap wood was thick, white and without odour; whilst the black heartwood was almost wanting. The tree was covered with foliage, and the inhabitants of the place assured me that neither flower nor fruit had yet been observed in the plantation, whilst I myself could discover neither fallen fruit nor seedlings under the parent tree. It was even asserted that the original plantation was formed from root-suckers, as this was the easiest and surest way of propagating the tree.

The root system of the tree was remarkable. The roots extended over a large area, and were dimorphous: that is, one part of the root system served evidently for the nourishment of the tree and the other for propagation. The first mentioned had no buds, and consisted of the usual main root with numerous side branches and branchlets running into the soil. But besides this there were 10 or 15 other roots from 6 to 13 metres long, and some 5 to 10 centimetres in diameter measured close to the parent stem.

They, however, rapidly decreased in diameter, and at a few metres from the tree were only 5 to 10 millimetres thick, or about the thickness of an ordinary pencil. These roots were very tough and woody, of a dull yellow color, and they grew horizontally sometimes only a few centimetres, sometimes deeper, below the surface of the soil; in some instances they even lay on the surface. The roots were not strongly branched, but on the under side were provided with numerous hair-like rootlets, which grew perpendicularly from the horizontally extending main roots. The horizontal roots bore numerous young shoots; sometimes on a root of one metre long and five millimetres diameter there would be five such shoots; in other instances, there was no young growth on several metres of horizontal root; but, speaking generally, there were from 16 to 200 young shoots for each tree of 16 years' old. The propagation root system of the selected tree having been dug up, the following results were obtained:—

I.—The tree had in 16 years produced 200 young shoots.

II.—The most distant shoots were 13 metres from the parent stem, and there had reached a height of two metres.

III.—Seventeen out of the 100 young shoots were over two metres in height.

IV.—The largest of all was 9 metres high, with a diameter of $8\frac{1}{2}$ centimetres, and this stem, besides having a perfect root system for the nourishment of the tree, was throwing out side-roots in preparation for propagation by root-suckers. The original parent

root, as thick as a pencil, from which this young tree had originally sprung, was still in connection with the young tree, although it was evident that the latter was quite independent of the parent stem, as was proved by the string root system of the new root-shoot and the want of growth in the original parent root.

V.—The sapling of 9 metres in height stood at a distance of 10 metres from the parent tree.

VI.—Some 25 young shoots were suppressed by thick growth of short grass* which covered the ground around the parent tree, but all the other young trees had grown up in a young plantation of *Cassia florida*, which had been formed on the other side of the parent tree, and in spite of the poverty of soil increased by the net-work of roots of the latter species, which intersected the ground in all directions, all the other root shoots of *Dalbergia latifolia* were flourishing. The three accompanying sketches are explanatory of the position. The *first* shows the parent tree with its root system for nourishment and two propagation roots. The *second* gives a plan of this latter root system, whilst the *third* illustrates the extraordinary development of the nourishing root of a 9 metre high young tree.

Another of the originally planted trees gave measurements of 22 metres high and 36 centimetres in diameter at breast height.

The above observations tend to show that *Dalbergia latifolia* possesses, besides its value as a timber tree, peculiar properties as regard powers of propagation.

I.—The tree is content with a stony, poor and dry soil.

II.—In such unfavorable circumstances (at an elevation of 250 metres above sea level) the tree attains in sixteen years a height of from 15 to 22 metres with a diameter of from 36 to 60 centimetres.

III.—The tree can be propagated without attention to sexual development by root cuttings and shoots.

IV.—The natural propagation by root-suckers is so rapid that in fifteen years a tree will be surrounded by vigorous young shoots, themselves capable of further propagation by their roots. But a ground covering of short grass is not favorable to the development of the young root-shoots.

V.—The peculiarity of the tree to cover from one parent stem in sixteen years a ground area of 500 square metres with young shoots, adapts it markedly for use in filling blanks, for each individual tree within that period would form a thicket of the species around it, and the cost would be considerably diminished, with a certainty of success.

*(Translator's Note).—More probably by the shade of the parent tree :
See sketches.

Whereas in those species, which do not throw out root-shoots, it would be necessary to put three plants into 1 square metre, it would be sufficient in the case of *Dalbergia latifolia* to plant one tree on 10 square metres of land, the cost being then 30 times less.

It is evident, therefore, that the cultivation of the Sono-Kling tree is worthy of consideration not only by Government, but also by owners of private forests.

I.—Because the tree is easily propagated without much expense.

II.—Because it flourishes in a poor soil.

III.—Because it furnishes a very valuable and beautiful cabinet wood, which in its wild state is becoming rare in Java, and whose export to Europe promises to be a pecuniary success.

I only observed the *Dalbergia latifolia* as a forest tree in Central and East Java in poor and dry soils, at a not greater elevation than 300 metres above sea level, and for this reason such situations are specially recommended for the cultivation of this tree.

A much commoner tree in Java is the so-called Sono-Kembang, *Pterocarpus indicus*, which, however, does not throw out root-suckers. The Forest Department in Java does not yet possess complete herbarium specimens of the Sono-Kling tree, the two varieties of Sono trees, viz., the Sono-Kling and the Sono-Kembang are, it is certain, totally different in form of leaf, habitat, color of the wood, etc., although both belong to the Leguminosæ, and for the correct determination of the two species I am indebted to Dr. J. G. Boer, Conservator of the Royal Herbarium at Leyden.

S. H. KOORDERS.

Failure of Natural Reproduction in the teak forests of the Coimbatore District.

The hope that the complete protection of the forests containing teak, situated on the Anaimalai Hills of the Coimbatore District, Madras Presidency, would secure a sufficient number of seedlings of that species, and of the more valuable of its companions, *Dalbergia latifolia*, *Pterocarpus Marsupium*, *Lagerstræmia microcarpa*, *Xylia dolabriformis*, to ensure the regeneration of the Forest by means of a natural and improved regrowth, has not been realised. For, in spite of the fact that a very considerable area in these forests has been completely protected from fire and grazing for the last 12 or 14 years, the number of seedlings of the above mentioned trees is not greater to-day than it was 14 years ago. The number of seedlings of inferior trees, and especially of *Grewia tiliaefolia* and *Anogeissus latifolia* has

slightly increased, and there is no doubt about the crop of grass, *Helicteres Isora*, *Acacia pennata*, *Cæsalpinia Coriaria* and other malignant, under-growth, which is magnificent and impenetrable. The reasons for this are not far to seek, as when protection was commenced the leaf canopy was not only broken, but the forests were so open that they resembled forests in which the secondary fellings had taken place, with this difference that there was no crop of seedlings covering the ground, which was hard and unsuitable for the reception and germination of seeds, more especially of teak. The excess of light was in every way favourable to the growth of the noxious stuff mentioned above, and when this undergrowth was once established, there was no chance for any unfortunate seed which might manage to germinate. In parts of the Tekadi leased forest a certain number of mature and back-growing trees (all too old to coppice), have been worked out during the last eight or ten years, under a system of selection fellings. But for the reasons mentioned above, these fellings have neither improved the existing stock nor assisted reproduction, and they had still further decreased the number of seed bearers. These particular forests (Punachi, Tunacadavu and Tekadi) are situated on tablelands 1,000 to 3,000 feet above sea level, composed of a succession of low undulating hills; the soil is deep and rich, and they are subject to the south-west and part of the north-east monsoons. From all accounts, their condition is very similar to the Wynaad forests in Malabar and to the Mudumalai* forest in the Nilgiris, except that as the rainfall is greater in the two latter districts, the chances of natural reproduction, owing to a denser undergrowth, are probably less. Cochin and Travancore both possess similar forests, and it would be interesting to know whether the officers in charge have arrived at the same conclusions as myself, which are briefly as follows:—

- (1). The reason so few seeds, and especially teak, germinate, is that the soil, owing to the open condition of the forest, has become baked. The consequence is that the seeds lie on the surface, and those which are not eaten by insects, birds, rats, squirrels, &c, decompose. This can be proved by raking up the soil under or quite close to seed-bearing trees, just before or just after the seeds fall, a regular nursery being the result: so also in cultivated patches, and to a lesser degree in damp places where earthworms are at work.
- (2). The reason that so few seedlings survive is attributable to the dense undergrowth (8 to 10 feet high) of bushes, grass and thorny creepers, which spring up, and also to the open condition of the forest.
- (3). Protection from fire has benefited in a certain degree the existing stock of mature trees, as it has prevented

* The natural reproduction in Mudumalai is not bad in fire-protected areas

further scorching, but it has done no good in the way of natural reproduction, as it has only encouraged the growth alluded to above.

- (4). The exclusion of cattle has done harm, as cattle would have kept down the grass and undergrowth. In a small area in the Tekadi Leased Forest, which has been heavily grazed by the bullocks which work the forest railway, the condition of the forest, so far as a tree re-growth is concerned, is distinctly better than it is in the area not grazed over.

When I say that the exclusion of fires and cattle has done no good, I refer only to these particular forests, or to others which may be similarly constituted and situated. The majority of the Madras forests have derived enormous benefit from protection.

In order to provide for the regeneration of these forests, the undergrowth must be removed, and the ground loosened. To effect this in the cheapest and most expeditious manner is what must be done; and probable financial results should be at any rate roughly calculated before any considerable sum of money is laid out; it would be folly to attempt methods which will not pay. The cheapest way would probably be to encourage heavy grazing (light grazing would have little effect on the grass and bushy undergrowth, it is so dense) in selected blocks or compartments for a year or two, this followed by protection would produce a certain number of seedlings. Another way would be to follow the Burma plan, and induce the Mulcers and other forest tribes to clear and cultivate the land, at the same time making them sow seeds or put out plants with their crops, this would require a range officer with considerable tact, as the forest tribes are indolent, and it is not easy to get them to do regular work. Where the ground is sufficiently free of undergrowth, loosening the soil with rakes and sowing broadcast would succeed. Clearing narrow lines through the jungle and sowing seeds, or putting in plants does not answer, as the lines soon become covered over by the adjoining grass and bushes, and the cost of constantly cleaning these lines is prohibitive; cleaning the undergrowth and sowing in patches answers better. Loosening the ground underneath the trees just before or after seeding succeeds very well, but is not sufficient, as the forests are so open that spaces between the trees require filling up. If seeds are sown they should be put in during February or March, so that they may get the benefit of the April and May showers, the seedlings or at any rate a certain proportion of them, will then be fairly started by the time the south-west monsoon begins in June.

H. J. PORTER.

The Cure of Snake-bite.

I take the following extracts from a book I have just been reading, namely, "Travels in India a hundred years ago, with a visit to the United States, being Notes and Reminiscences by Thomas Twining, a Civil Servant of the Honourable East India Company, preserved by this son, Thomas Twining of Twickenham, and edited by the Rev. William H. G. Twining, Vicar of St. Stephens's, Westminster, with Portraits, Map———London, James R. Osgood, McIlvaine and Co.———1893.

"The couvre-capelle above described was apparently five or six feet long, and about as thick as a man's wrist. This snake is the most dangerous and destructive one in India, being the most common and the most domestic, that is, seeking houses where it secretes itself in the holes and chasms of the mud walls, in the thatched roofs, or under the hollow terraces. Its bite is fatal in a few hours.

"At a later period, when in charge of a district containing a great population, upon which it was my duty and, I may say, my earnest desire to confer the little good in my power, I had many most distressing opportunities of observing the dangerous qualities of those snakes, but I had also the satisfaction of saving the lives of many persons bitten by them. * * * These persons were brought to the door of my residence upon charpoys * * * or, in near and recent cases, were led, resting upon the arms of two of their friends. They were in different stages of the dreadful affection, according to the time which had elapsed since the accident had happened. All seemed to suffer extreme physical depression; many were speechless, some lock-jawed, in some the spark of life was scarcely perceptible, in some it was quite extinct * * * But in almost all cases, where life remained, it was eventually preserved by the following simple preparation, communicated to me by a medical friend, who had experienced its success:—

"*Nassauda (Sal ammoniac)* one *seer*, fine *chunam* two *seers*, water six *seers*, distilled in the way practised by the natives in making their rose-water.

"To effect a cure, give a full-grown person from sixty to eighty drops in about double the quantity of water; if this does not produce sickness at the stomach in ten or fifteen minutes, give about two-thirds of the same dose every two or three minutes until sickness is produced. When the person has once retched, whether by the first or second dose, give again about one-half or two-thirds of the first quantity, and repeat it in the same manner until it makes him sick a second time, when the cure will be complete.

"The great object was to produce vomiting: when this was effected the recovery of the patient was almost invariably the consequence; but where the sufferer was too far gone for the liquid to be administered or to act, death was the certain result. I always had a supply of the medicine ready at my house, and also at the public Cutcherry or Treasury, where my offices were, and where Mr. Cock resided, to whose willing co-operation on these painful occasions, I, and more especially the natives, were much indebted. Our efforts scarcely ever failed where the arrival of the person had not by necessity or negligence been delayed too long. * * One day a respectable man of about thirty, one of the ryots or cultivators of my district, arrived in a dooley * * from a village about eight miles off. The man in the dooley had the appearance of a corpse, and was in the usual position of one lying upon his back, his head resting upon a low pillow, his hands straight by his side, and his naked knees bent up. I desired him to be brought into the shade of the verandah at the bottom of the great stairs, and went down to him with a bottle of the mixture. At the same time I sent to the Treasury requesting Mr. Cock to come. I do not recollect for certain what species of snake it was that had bitten the man, but I believe it was a *couvre-capelle*. I always desired that the snake when killed might also be brought, but this was seldom done. I found the man alive, but speechless and insensible. Such a state in an European would perhaps have appeared desperate; but I had had numerous opportunities of observing that the insensibility of a native of India in such cases was often as much the result of his natural resignation and extraordinary indifference to death as of physical exhaustion. It was evident, however, that more quick and decisive measures than usual were necessary to save him. I therefore ordered my servants to force his mouth open, and to pour down his throat the usual quantity of the mixture, but almost pure. I hoped that its scalding in this state might revive him, and render him more sensible to its intended action. The first effect was at once visible. He felt the burning pungency of the strong liquid. Thus partially revived, we gave him, after a few minutes, a further quantity more diluted, and now anxiously awaited the important symptom decisive of his fate. His stomach became affected, and I had the satisfaction of announcing to his friends that he was saved. The next day he was able to return home, complaining merely of weakness, and of the excoriation of the throat, as all my patients did, but which a decoction of linseed or other emollients removed in a few days.

"I had such proof of the efficacy of the above treatment during the last year that I remained in India, that I intended establishing depots of the mixture or of the materials composing it, with instruction for its preparation and use, in the principal towns and villages of my district; but the necessity of returning to Europe on account of my health prevented the execution of this

design, as well as some other plans likely to be beneficial to the population under my charge. Had this further trial succeeded, I intended to propose it to the Government for general adoption."

I am no chemist, and have no book on chemistry by me, but I presume that the combination of chlorine with ammonia, or of hydrochloric acid with ammonia—the dictionaries at hand seem to think that either of these combinations is "Sal ammoniac"—does not lessen the power of ammonia as a stimulant, and that therefore *Sal ammoniac* would act as a stimulant equally with *Liquor ammoniac*, the antidote usually administered in cases of snakebite. But the point I wish to draw attention to is, that Mr. Twining, on the recommendation of his medical friend, administered a solution of *Sal ammoniac* as an emetic, and that he says nothing, directly, as to the stimulating effect of the medicine. The great object, he says, 'was to produce vomiting: when that was effected the recovery of the patient was almost invariably the consequence.' But in the case of which he gives particulars, as the patient had been brought from a distance of eight miles, and was in a collapsed state he forced down his throat the usual dose, but almost undiluted, hoping that the scalding effect might revive him and render him more sensitive to the intended action of the medicine, namely, as an emetic. The burning pungency of the strong liquid partially revived the man, and he was then able to take the usually diluted dose, which produced the vomiting which Mr. Twining called "the important symptom decisive of his fate." On referring to an old Edition of Moore's Manual of Family Medicine for India, the only medical work at hand, I find that sickness, and probably vomiting, are said to be effects of snakebite, while it is not said that the administration of *Liquor ammoniac* or *Eau de luce* is ever followed by vomiting: that antidote is administered simply as a stimulant, and to produce reaction from the depressing effect of the poison. I may, therefore, assume that *Liquor ammoniac* does not act as an emetic,—indeed I know from experience that it acts as a sedative: in fever and ague a tea spoonful of *Sal volatile* in water may make one comfortable in a few minutes.

In the course of a long residence in India, I have never read or heard of *Sal ammoniac* (*nassauda*) being used as a remedy for snakebite, and, as an antidote to that calamity is still a desideratum, I think it worth while to bring Mr. Twining's experiences to notice, with the view of eliciting information and inducing experiment; and I do not think I could choose a better medium for doing so than the *Indian Forester*, as snakes are to some extent "forest produce," and forest officers must be, as much as any other Government servants, in the way of meeting with cases of snakebite, and must therefore have many opportunities of treating them. Should the *Sal ammoniac* mixture be found effective, a stock of it might be kept at Forest *Chaukis* and *Bungalows*, as well as at every *Tehsil* and *Thana* in India.

I have omitted to allude to the admixture of “fine *chunam*” with the *Sal ammoniac*, in the proportion of two to one. If this means quicklime, perhaps it is the internal slaking that produces the vomiting.

I have myself seen only one case of snake-bite during upwards of 34 years’ residence in India, and that was not far from Sasseram, in Shahabad—Mr. Twining’s head-quarters. I was in camp, with a brother canal officer, when a man was carried to us, apparently far gone. His friends said he had been bitten by a *karait* in his house, and a small wound on the sole of his foot was shown to us as the bite. The man was sometimes convulsed and insensible. We had no ammonia in camp, but administered about one-third of a bottle of brandy (or whiskey, I forget which) somewhat diluted, in several doses, and caused the man to be kept on his feet, and dragged about. Half the village was round us,—the elders calling on all their gods for help. They evidently believed it was a genuine case of snake-bite. Within half an hour the man was so much better that he was taken home, and next day he came to the camp, and returned thanks to us for having cured him.

C. W. HOPE.

MUSSOORIE, }
16th July, 1894. }

The Preferences of Lightning.

(From the Revue des Eaux et Forêts.)

It is well-known that under similar conditions lightning does not strike trees of all species impartially. Accepting this as a fact, observations have been made, with a view to obtaining more definite information on the subject. These observations, which extended over a period of fifteen years, were carried on in a large forest composed of 11 per cent. oak, 70 per cent. beech, 13 per cent. spruce and 6 per cent. pines.

During the period above mentioned 159 oaks, 21 beeches, 20 spruce, 59 pines and 21 trees of other species were struck by lightning, that is to say, taking equal numbers of trees of each species, for one beech there were 48 oaks, 33 pines and 5 spruce struck. This shows that the oak is especially attractive to lightning, whereas the beech is, comparatively speaking, unharmed by it.

Attempts have been made to explain this phenomenon as being due to the difference in the form of the crown of the two trees, that of the oak being more or less pyramidal, whereas that of the beech has a tendency to become spherical. This explanation is, however, hardly sufficient, as this difference in form of the crowns is not often very noticeable in trees which have grown up

together in close canopy; and, moreover, in the above mentioned cases, the electricity left the tree much oftener by the trunk, than it did by the crown, *i. e.*, in 197 cases against 78.

Another explanation, more rational than the above, is that which, in accordance with the theory of electricity, attributes the preferences of lightning to the different conducting powers of woods of different species. This explanation, which until recently was nothing but a simple hypothesis, has been verified by experimenting on the resistance offered by different woods to the passage of an electric spark. A report on the results of these experiments has recently been submitted by M. Jonesco Dimitric to the Society of Natural Sciences of Wurtemberg.

Pieces of the same shape and size taken from the sapwood of trees of various species were subjected to the action of a Holtz electrical machine. At the first or second turn of the wheel, the spark passed through the specimen of oak; twelve to twenty turns were required for beech, five for poplars and willows, &c., &c. Pieces taken from the heartwood of the different species gave absolutely similar results.

It was next ascertained that the proportion of water contained in the specimens had no influence on the conduction, but that the presence of a greater or less quantity of fatty matters in the tissues had a preponderant effect.

Species, of which the wood contains a large quantity of starch, like the oak, poplars, willows, maples, elms and the ash offer much less resistance to the passage of an electric spark than do those of which the wood contains much fatty matter, like the beech, the lime and the birch. The Scotch pine, which is impregnated with oily substances during the winter, contains very little of these in summer, and the wood of this tree was found to be a bad conductor during the former season and a good conductor during the latter. Another proof, yet more conclusive, is that the wood of the beech deprived of the fats which it contains, by means of ether, offers no more resistance to the spark than does the wood of the oak.

In conducting the above experiments it was found at the same time that the bark and leaves of all trees, irrespective of species, were bad conductors, and that dead or dying trees were in all cases better conductors than trees in their full vigour.

From the above it follows that if shelter is sought in a forest during a storm, it is safer to choose a tree of which the wood is rich in fats, it will afford relative, though not absolute, security from lightning, for when the electric tension becomes too great the spark, a flash, will escape by any tree of no matter what species.

A. F. G.

[We print this in continuation of an extract which we gave at page 241 of the present Volume. We are unaware of any observations made in this country, but we have noticed that in the N.-W. Himalaya, blue pine and deodar seem to be more struck than the broad-leaved trees which accompany them—HON. ED.]

Tannin in Indian Oak Barks.

Oak bark has been used for a very long time as a tanning agent in England, and the bark is obtained from the *Quercus Robur*, under its two forms *pedunculata* and *sessiliflora*. In America, the black oak bark is used for similar purposes, and is procured from *Q. Coccinea* var. *tinctoria*, Gray, growing in the woods of North America as far west as Minnesota and Texas. The amount of tannin in European oak barks is given by Professor Procter as between 10 to 12 per cent. Weiss, a German chemist, in 1885, examined 15 commercial specimens of oak bark from Hungary, Germany, France, Denmark and Sweden, and the mean percentage of the tannin, calculated on the absolutely dry bark, was 13.5. In 1878 Eitner examined the barks of the two sub-species of British oak at different times of the year, and his results seemed to point to the conclusion that during the months of May and June, the barks yielded a larger quantity of tannin than at other times of the year, and that the *pedunculata* was always richer than the *sessiliflora*. The tannin in the American oak barks varies from 3.91 to 14.21 per cent., according to Professor Trimble of Philadelphia. The tannin from these species of oaks is said to be identical, and is called *Quercitannic Acid*, but in the barks the tannin is accompanied with colouring matters, which differ very widely from one another.

Professor Trimble is the author of a work on "The Tannins," which has already formed two volumes, and as he has been studying the history and chemistry of English and American oak barks, he wished to compare their value with the barks of the oaks which grow in the Himalayas. At my request, Mr. A. E. Wild of Dehra Dûn kindly forwarded to Philadelphia the barks of four species of Indian oak, named as follows:—

<i>Quercus annulata</i>	(Inai).
„ <i>incana</i>	(Ban).
„ <i>dilatata</i>	(Moru).
„ <i>semecarpifolia</i>	(Karshu).

The amount of tannin in these barks was estimated by the "hide-powder" method. Powdered or rasped hide was originally proposed by Sir Humphry Davy, and was adopted as a satisfactory method by Karl Hammer in 1860. A solution of the tannin material is first made with water, and the specific gravity of the liquor is taken. The liquor is then digested with some hide for a few hours, filtered, and the specific gravity again taken. The loss in specific gravity on account of digesting with hide represented the tannin; a loss of .004 indicating one per cent.

Professor Trimble obtained the following results upon examining the Indian barks:—

	Tannin in air- dried bark.	Moisture.	Tannin in dry bark.	Ash in dry bark.
<i>Q. annulata</i>	11·37	6·85	12·20	11·30
„ <i>dilatata</i>	7·40	6·88	7·94	10·02
„ <i>incana</i>	22·12	5·31	23·36	11·06
„ <i>semecarpifolia</i>	7·99	7·04	8·60	10·88

The tannin from the last named bark was purified and submitted to combustion in order to obtain its ultimate composition. It contained :—

Carbon	... 60·15.
Hydrogen	... 5·19.
Oxygen	... 34·66.

The similarity in behaviour towards reagents indicated that the tannins from these four barks are identical with one another, and with that from several species of oaks indigenous to America recently investigated by Professor Trimble. The ultimate analysis of the tannin from one of the above sample confirms the opinion that in them we have a tannin identical with that from other species.

The amount of tannin in two of the species exceeds the amount found in the American oaks, while that in the other two is equal to the average tanning capacity of those barks. The bark of the *Q. incana* is much higher in tannin contents than any European oak, and it would, from these results, be a matter of great interest to know if Indian oak barks could not be used more extensively for tanning purposes in this country than they are at present.

D. HOOPER.

[Note.—We have also received, from Mr. A. E. Wild, a copy of a paper on the same subject, by Mr. H. Trimble, published in the 'American Journal of Pharmacy' for June 1894. Ban oak bark could probably be supplied in considerable quantity, say, at Cawnpore, but the difficulty would be the cost of freight from the Hill Forest.

HON. ED.

II.-CORRESPONDENCE.

The Forest Department in Madras.

DEAR SIR,

Your article of the Madras Annual Report for 1892-93, coupled with the "Rules for the training of Junior Assistants in Madras," also published in your May number, show plainly that the tendency in this Presidency is to bring the Department on to the same level as the "Salt and Abkari," in which rules are laid down for the manner in which work is to be done during twelve hours per day and $11\frac{1}{2}$ hours per night. Conservators are rapidly being reduced to ornamental nonentities, whose abolition, if the present system continues, is merely a question of a few years' time.

They have no power, either financial or administrative, their work being limited to the inspection of forests, with *permission to advise* Collectors; they are not allowed to prepare annual reports for their Circles, and they have no powers to sanction expenditure. The District Forest Officer is no longer a trained man under a trained Conservator, working the forests in his charge for their benefit, subject to the approval of a trained Conservator, but a machine carrying out the orders of the Collector and the Board of Revenue, and preparing reports and tabular statements *ad lib.* If, while on tour he comes across a piece of unforeseen work, which he wishes to personally superintend (*e.g.*, the correction of a boundary line, the preliminary trace for a road, or the marking out of compartments) he must first sit down, estimate the cost of the work, even if it be only Rs. 2, and obtain the sanction of the Collector.

The Salt and Abkari Department is very perfect in many ways, and all praise is due to the able officer who made it what it is, but if the Forest Department is to be managed in the same way, why should its officers have to undergo a long and expensive training before they can join their appointments? No member of the Board of Revenue would attempt to dictate to an Engineer what should be the depth of a girder, or how much waterway was necessary for a certain stream, but for Forest Officers, the law is laid down on all points, and yet if a three years' course of training is necessary for Forest Officers, it is evident that there must be technical points in their work which no untrained man can master in one or two or ten tours of inspection, the real object of which is to see how much more revenue can be received out of the forests, and how many more returns and reports can be extracted from the Forest Office, to further (in your words) "the compilation of records to give honor and glory to a member of a Board of Revenue."

The Forest Estate of the Madras Presidency is one of great value, it requires nursing, strengthening and developing, operations to which Forest Officers have but little time to devote, owing to the heavy office work they are burdened with, but operations which trained officers, properly supported, are alone competent to carry out, and which cannot be regulated by rules drafted in arm chairs in Madras.

MADRASSEE.

Promotion in the Bombay Forest Department.

SIR,

As a covenanted officer of the Bombay Forest Department I beg to enter a protest against the assertion by 'A Bombay Officer' in your July number that 'a strong feeling of discontent' exists in the Department on the subject of the extension of service granted to the Hon. A. T. Shuttleworth. Any 'feeling' there may be in the matter on the part of those officers of the Department who

have the good fortune to serve under the Hon. Mr. Shuttleworth is, I imagine, of a precisely opposite kind. We know very well that we shall never get such another 'chief,' and some of us would be unfeignedly glad to hear that he would still be fighting our battles 5 years hence.

If we are to assume that the C. S. Regulations have any meaning at all, it is evident that the rulings under Sect. 503 (c) completely demolish the special pleading of 'A Bombay Officer's' two last paragraphs.

NANCEIEN.

SIR,

Allow me to emphatically deny the "strong feeling of discontent" alleged by "Bombay Officer" as to the extension (so-called) of the Hon. Mr. Shuttleworth's service. It is well known that one man is discontented, and another remembers that Mr. Shuttleworth once had occasion to evil-entreat him officially. I doubt if a third or fourth could be found, but if any more fuss is to be made, it will be easy to poll the Dept. by postal ballot. So much for sentiment, now for law. As the rules appear to me, Government has no choice in the matter, unless it likes to declare that Mr. Shuttleworth is mentally or physically inefficient. This step, I rather think, it will hesitate four or five years before taking. If Mr. Shuttleworth gets an extension (he did not ask for the present one) after he is 60, it will be time enough to protest.

I regret extremely that "Bombay Officer" has thought fit to raise such a question. It is quite true that we have great cause for discontent here in Bombay, but I would remark, as gently as possible, that those who are now in arms are, I think, precisely the men who have sat most *chup*, while others risked their skins in the battle.

ECLAIREUR.

SIR,

In the July issue of the *Forester* you have inserted a letter signed 'Bombay Officer,' stating that "a strong feeling of discontent exists among the covenanted officers of the Bombay Forest Department owing to the rumour persistently current, that an extension of service is about to be granted to the Hon. Mr. A. T. Shuttleworth, Conservator of Forests, 1st grade." I wish to contradict any impression that may be created that such discontent is at all general amongst us, that there is discontent amongst some officers, I know, but there are also a number of us, including most officers who are now serving, or have at any time served under him, who are not at all anxious to see Mr. Shuttleworth leave the Department; and who, in fact, hope that he will remain with us for some time yet. "Bombay Officer's" letter is apparently designed to prejudice Mr. Shuttleworth's chance of getting an extension. We, therefore, hope that the report is true that an extension of one

year has already been granted. Mr. Shuttleworth has done splendid service for the Bombay forests—service that might well have been recompensed with the C. S. I. long ago. He has worked unselfishly in the interests of the Department, and has always been a true and loyal friend to every officer serving under him. We are, therefore, not all of us so ungrateful as to wish to see him compulsorily retired under the 55 years' rule ; more especially as under the rules applicable to him he can continue to serve, provided he is physically fit. Regarding this there can be no doubt. Mr. Shuttleworth is as vigorous and active as many men 20 years his junior, and as conscientious in inspecting the forests as any man in the service.

It is but too true that Bombay Officers are singularly unfortunate as regards their promotion, but that is due to the reduction of the number of our Conservatorships from three to two. This was principally due to the mistaken opinion of a Staff Corps Colonel, formerly Conservator, that the forests of Sind could be managed by native officers under a limited European supervision, and that a Conservator there was not required. We live in hopes of soon seeing that Conservatorship restored, and with it the creation of a fourth Conservatorship, doing away with the present anomaly of two circles in charge of Deputy Conservators who hold the position and powers of Conservators without the pay.

"Bombay Officer" in giving his examples of how unfortunately we are situated has omitted to mention the hardest case of all, that of Mr. F. R. Dasai. Mr. Dasai is the only member of the first batch of Nancy men now left in the Bombay service, and his rank is still only that of a first grade Deputy Conservator, and though he has held charge of the Northern Circle for 18 months he has never even acted in the grade of Conservator ! He has always worked well, and has had the commendation of Government, yet after 25 years of approved service he is still a long way from a Conservatorship. No parallel can be found for his case in any other service in India, though "Bombay Officer" has shewn but too truly how hard the block in promotion in Bombay has told on other senior officers on our list.

There can be no question of the "justice" of an extension of service being granted to Mr. Shuttleworth. Under the rules applying to him, it would be an injustice to make him retire at 55. I have not seen the new rules lately applied to convenanted officers of the Forest Department, but I have been a fair number of years in India, and I understood before I came out that I should have to go at 55, *volens volens*. The question of a "breach of faith" on the part of Government need not be considered.

NANCY.

[NOTE.—We hope our Bombay correspondents will excuse us if we now allow this discussion to close.—HON. ED.]

III.—OFFICIAL PAPERS & INTELLIGENCE.

Re-issue of the Annales Forestieres.

In our note on this subject on page 264 of the July *Forester*, we hardly made it sufficiently clear that the sets were not quite complete, and we have now been reminded that the following are missing :—

Revue des Eaux et Forêts	1864 to 1866
Répertoire de Legislation, etc.,	1863 to 1870

We were not quite right in talking of a 're-issue,' as the books really are the old issue being sold off, but remarkably cheaply, in our opinion, even with the omissions above referred to.

Is the Removal of Drift Timber a Forest Offence?

The following recent judgment of the High Court of Calcutta will be read with interest by those who are in charge of drift collection works.

RIGHTS OF A FOREST OFFICER.

"In the case of the Empress *vs.* Ashkar Ali, the facts of which have been reported, in which Mr. P. L. Roy appeared on behalf of the petitioner, their lordships delivered the following judgment, which deals with the facts of the case :—The petitioner Ashkar Ali has been convicted of an offence under section 224 of the Penal Code, and has been sentenced for such offence to four months' rigorous imprisonment. He has also been convicted of an offence under section 147 of the Penal Code, and he has been sentenced to three months' rigorous imprisonment in addition under that section. We are of opinion that the conviction cannot stand in either case. The offence which has been created by section 224 is the intentional offering of resistance or obstruction

'in the lawful apprehension of a person for an offence with which
 'he is charged and of which he has been convicted ; and in this
 'case it has been held by the lower courts that the peti-
 'tioner, Ashkar Ali, resisted his lawful apprehension by one
 'Mr. Barrett, Deputy Conservator of Forests, in the District
 'of Cachar. The Assistant Commissioner, in dealing with
 'this matter, has held that Mr. Barrett was entitled to
 'arrest Ashkar Ali, inasmuch as he entertained a reasonable sus-
 'picion of his having been concerned in a forest offence, and the
 'forest offence of which he finds that Ashkar Ali was suspected,
 'was apparently the removal of drift timber from the banks of the
 'river before payment of royalty. He holds that a suspicion of
 'having been concerned in the theft of drift timber would not be
 'sufficient for a conviction, inasmuch as the theft of drift timber
 'is not a forest offence under the definition contained in the regu-
 'lations. The Sessions Judge, on the other hand, no doubt, ap-
 'parently considered this question very carefully, having held that
 'Mr. Barrett had ground for holding that Ashkar Ali had stolen
 'or dishonestly received forest produce, and he apparently seems
 'to regard that the theft or dishonest receipt of forest produce is
 'a forest offence under the regulations. The term "forest offence"
 'is defined in section 3 of the Assam Forest Regulation by Regu-
 'lation 7 of 1891. 'Forest offence' means an offence punishable
 'under this Regulation, or any rule thereunder. The theft
 'or dishonest receipt of drift timber is not stated to be an offence
 'under the Regulation, and there is apparently no rule under which
 'that could constitute a forest offence, and such a rule was, of
 'course, unnecessary, inasmuch as it is an offence under the Penal
 'Code. But turning to the finding of the Assistant Commissioner,
 'we must refer to the provisions of chapter 7 of the Regulation,
 'and under that chapter it does not appear that the removal of
 'timber from the banks of the river without payment of royalty is
 'a forest offence either under that chapter or under any rule made
 'in accordance therewith. The chapter lays down that drift
 'timber may be collected by any forest officer or other person
 'entitled to collect the same, and brought to such station as may
 'from time to time be notified. It then goes on to say that notice
 'of the timber so collected shall be published and claimants invited
 'to come in and substantiate any claims they might have, and that
 'such timber which is unclaimed shall vest in the Government free
 'of all incumbrances. Then section 47 provides that claimants
 'entitled to recover possession shall not remove the timber until
 'the royalty has been paid, and section 48 empowers the Local Gov-
 'ernment to make rules to regulate certain matters under this chap-
 'ter, but none of the matters therein mentioned has reference to the
 'removal of drift timber from the river by persons who are not
 'authorised to collect it. It seems to us clear, therefore, under
 'this regulation, that the act of removing the drift timber from the

'banks of the river before payment of royalty is not a forest offence, though, of course, as we have said, it may be an offence under the provisions of the Penal Code. Now Mr. Barrett's power of arrest is defined by section 60 of the Regulation, which runs as follows :—

'Any forest officer or police officer may without orders from a Magistrate and without a warrant, arrest any person reasonably suspected of having been concerned in any forest offence punishable with imprisonment for one month or upwards, if such person refuses to give his name and residence, or gives a name or residence, which there is reason to believe is false, or if there is reason to believe that he will abscond. Now we have already pointed out that there was no reasonable suspicion of any forest offence having been committed, and this section does not authorise Mr. Barrett to arrest the petitioner on a suspicion of having committed any other than a forest offence. Further, the power of arrest is limited by the concluding words of the section. Mr. Barrett was well aware of the name and residence of the petitioner ; he was in fact at the very time at the petitioner's residence, and considering the position of the petitioner and his father, it seems to us that there was no ground for that he was likely to abscond. Under these circumstances we think that Mr. Barrett had no authority whatever to arrest the petitioner, and that in resisting that arrest, the petitioner has committed no offence. That being so, we think that the conviction under section 224 of the Penal Code must be set aside. Then, as regards the offence under section 147, the judgment of the Sessions Judge is altogether silent. What the Assistant Commissioner says is this :—' It was quite clear from the evidence that there was riotous assembly, the common object of which was assault and forcible obstruction to public servants,' and the facts, as set out by him in the former part of his judgement, are as follows :— After Ashkar Ali had offered resistance to his arrest and had run inside his house, the Assistant Commissioner, says Ashkar Ali, began to shout out most abominable language, and cried out seize the *sahib* and take away the receipt. About a dozen men ran after Mr. Barrett, shouting out 'give back the receipt'. Mr. Barrett was pursued for some distance by the men, who however gave up chase. Now there is no finding here that Ashkar Ali was one of the parties who pursued Mr. Barrett, or assaulted Mr. Barrett. Apparently he remained inside his *bari*, and the mere fact that he called out to the others to seize the *sahib* and take away the receipt is not, we think, sufficient ground upon which we can say that he committed a riot. It seems to us therefore, that he was not properly convicted under section 147 of the Penal Code, and that this conviction also must be set aside. The result is that both convictions must be set aside, and the petitioner released.

IV.--REVIEWS.

Forest Administration Reports for 1892-93 for Ajmere, Berar and Baluchistan.

The AJMERE Report is noticeable for the record of an improvement in the conditions under which grazing is allowed. In 1891-92, almost the whole area was thrown open: in the year under review 43·6 per cent. of the total area was closed; and in the open portion grazing was only allowed for 4 months. The Government of India have expressed their satisfaction at this, and we may hope that the arrangement will continue, and that the young officers of the Ajmere Staff will understand that what they consider only grazing grounds are being converted into forest by degrees.

The chief item in the forest history of the year was the preparation, by Mr. Coventry, an Assistant Conservator, deputed from Berar, of a general scheme for the regulation of forest working, including grazing management; and this scheme, we hope, we shall soon be given an opportunity of discussing. The financial results of the forest year were:—

Revenue	...	Rs. 13,323	} the deficit being due to the pay of the Assistant Conservator on special duty.
Expenditure	...	„ 15,630	

The Berar Report is submitted to Government by Colonel Kenneth Mackenzie, the Commissioner, and as this is the last Report which he expects to review, he has recorded his opinions on the subjects of recruitment and departmental policy and history, and these we think it right to extract:—

“As Mr. Bagshawe points out in his report, there is very ‘great difficulty in getting physically fit and suitably educated ‘young men now to enter the Ranger’s grade; and everybody, ‘who is acquainted with the facts in the background, will agree ‘that a potent cause for this is the comparatively poorer prospects ‘that such men at present have in the forests, as compared with ‘openings in other departments. Consequently it will certainly ‘pay Government directly and indirectly to improve the position ‘of the upper subordinate grade in the manner now before the ‘Resident and the Government. I do not think that the hard ‘work, the loneliness, the sickness that these men have to face,

'comes home in anything like the reality to those ultimately responsible for their welfare, as it does to those who, like myself, are locally more frequently and continuously brought into intimate relation with facts. As bearing on this question, I happen to be in a position to give exceptional evidence: for it fell to me, as Assistant Commissioner, in 1866, nearly 28 years ago, to select and demarcate our main reserves and to start under the direction of Colonel George Pearson, the Conservator at that time common to the Central Provinces and Berar—what is now the Berar Forest Department—and of all the men I then enlisted, though with one or two exceptions they were all young men of excellent physique and locally acclimatized, but two now survive—Misri Persad and Ahmed Ali.

'For a reason that will presently be apparent, I wish to record that our forest policy up to date has been to take up suitable areas for permanent reservation, and to work these up to a healthy condition by fire conservancy and general protection, and during the time requisite for this, we met the demands of the province mostly from the unreserved or open forest, which ultimately was destined, where not cultivated, to meet the demands of grazing. The result has been that the cost of administration was very cheap, and an abnormal surplus possible. Now that the unreserved areas are being worked out, and the permanent reserves are in a condition to be, and are being drawn upon more and more, the cost of working them must rise; for, in a permanent reserve, the cost of regulating forest operations naturally must be more costly than what, as above described, was previously the case. I think it is very necessary to recognize and bear this in mind, for a failure to do so might lead to a reduction of working charges, which would, I consider, undo the work of over 25 years, and would risk the future of a forest property, in the Melghat, of considerable and rapidly-increasing value.

'Intimately connected with the welfare of the forests is the prosperity of the people in and immediately around our reserves. Their well-being, on which follows their good will, depends on the wise adjustment of our forest concessions to their necessities. Luckily our position, especially in the Melghat, our chief forest tract, enabled us to be liberal, with the result that the people in the hill tracts are well affected towards us. They practically form an unpaid protective force, of great value, in addition to our own staff. Without their ready and willing assistance our great success in fire conservancy would have been impossible. I trust nothing in the future may cause a break in this policy.

'I have ventured to attract special attention to these points, which I conceive to be of great importance, as possibly this may be the last Hyderabad Assigned Districts Forest Report which it may be my privilege to review, and because having been more or less intimately associated with the Forest Department from

'its start, I am naturally interested in its welfare. It fell to me, 'as Assistant Commissioner and Conservator in 1865-66, to make 'the first Hyderabad Assigned District Forest Report, when the 'forest revenue of the Melghat, then our only forest, returned for 'the year Rs. 25,000. The average of the Melghat forest revenue 'for the last five years has been Rs. 1,76,256 per annum. In '1890-91, a year of unprecedented prosperity, its revenue touched 'Rs. 1,99,875. The entire provincial forest revenue for the last 'year of the report now being reviewed, *vide* annual form 65, was 'Rs. 5,38,509, with charges amounting to Rs. 3,05,655, leaving a 'surplus of Rs. 2,32,854.

"Several officers have come and gone since the start, most of 'whom in their turn piled up the cairn of good forest work, but 'to none is the province more indebted for laying a good founda- 'tion on which the present rests—a foundation laid in critical 'times and in the face of considerable difficulties, from within and 'without, than two whom I would venture to name—Mr. Alex- 'ander Drysdale, who has retired, and Mr. John Ballantine, who 'is now on furlough in view to retirement.

"The present Conservator, Mr. Bagshawe, and the writer of 'the report, was himself formerly here for a time, and we are, I 'consider, lucky in obtaining his services again. The Resident is 'aware, from references that have gone before him on various 'points of importance since Mr. Bagshawe's return and assump- 'tion of charge, how very thorough and complete his work is, and 'how exceedingly I am indebted for the assistance he has so 'cordially rendered me, and which I am only too glad to thus 'acknowledge."

In other matters, too, Colonel Mackenzie's letter is very interesting. In regard to the question of pasture-feeding *versus* stall-feeding for cattle he says:—

"It can hardly be denied, I think, that the more extensive the 'area open throughout the year to pasturage, the greater the 'ability to maintain weak and useless stock, and the greater the 'difficulty of improving the breed. This ability, too, to let their 'cattle roam unchecked makes it impossible to effectively control 'cattle-disease, which in epidemic form is, we know, periodically 'so disastrous to agricultural interests. Therefore it seems to me 'that the true solution is to facilitate stall-feeding, and to restrict 'the areas open to indiscriminate grazing. The subject requires, 'however, to be dealt with gradually, cautiously and carefully. 'The hope for Berar, in my view, is, that already there is a good 'deal more done in the stall-feeding line than is generally recog- 'nized, or than is the case, I believe, in other parts of India. In 'the richest parts of Berar the people *volens volens*, stall-feed the 'cattle actually in use—and here we find really some of the finest 'specimens of the breed, for which the province is noted."

And we note, with satisfaction, that the Government of India approve his remarks.

The Conservator has given a classification of the State forests, which is interesting. The forests are now being maintained and worked :—

			<i>sq. miles.</i>
For timber and fuel	...	...	1,322
„ fodder and high grass	...	...	63
„ pasture	...	...	1,598
(As yet unclassified)	...	...	1,250
Total			4,233

Fire protection was not very successful during the year, but there has been considerable improvement in forest growth, and the Conservator says :—

“In the Bairagarh and Gugumal Forests of the Ellichpur Division the advance in natural reproduction is most marked, Mr. Prevost in his report says ‘in no previous year have I seen so many seedlings, while the saplings and poles of all kinds have made most astounding shoot, and in very many places the teak, tiwas and haldu poles present the appearance of a fully stocked plantation : speaking roughly, it may be said that in the past three years the forests have filled up and the advance growth closed up more than it did in the previous ten years.’

“The Commissioner, Colonel Mackenzie, visited many parts of Bairagarh that he had not seen for several years, and he also was much struck with the marked improvement now so very apparent. Personally I think the change that has taken place during the past ten years is most striking, whether we look at the general appearance of the forest or notice specially the teak, haldu or bamboo growth ; and the present condition of natural reproduction in the Melghat reserves is a triumphant testimony to the soundness of the forest policy introduced, and for so many years persistently supported, by Colonel Mackenzie.”

The financial results of the year shewed :—

Receipts	Rs. 4,31,835
Expenditure	„ 2,49,527

Surplus	„ 1,82,307
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which, we suppose, goes to the Nizam.

In the *Baluchistan* Report there is much of interest, and especially interesting is Mr. Elliott's account of his tour in the Zhob District in the autumn of 1892. He found five points of special note, which we reproduce :—

- “(1) The pistacio *P. Cabulica* (khanjak) forests in the upper part of the district, such as that in the Babu China Valley near its junction with the main Zhob Valley at Valtoi, Toi, and elsewhere.
- (2) The sudden appearance of the olive a little above Fort Sandeman and its occurrence in pure forests over a large area in the lower part of the district.

- (3) The occurrence in the east part of the district of large tracts of *Acacia modesta*, crossing a small range about 25 miles east of Fort Sandeman, which virtually separates the drainage flowing south-east to the Vihowa pass into the Punjab from that which flows north and west; the olive suddenly ceases and its place is taken by the "phulai" (*Acacia modesta*), which is found all through the Musa Khel country, down to the Anambar river at the east end of the Bori Valley. In one place on the summit of the dividing range just mentioned, some box was found, the only place in Baluchistan where it has been discovered.
- (4) The juniper is almost unknown in Zhob. It occurs at the west end in small numbers, and of stunted growth.
- (5) On two ranges, "Ghastoi" or "Speraghar," about 30 miles north-west of Fort Sandeman, and "Shingarh," about the same distance to the north-east, there is an abundant growth of *Pinus Gerardiana*, a tree which is said to be carefully protected by the Pathans on account of its edible fruit; nevertheless, there is considerable damage by fire; the former named forest is poorer than the latter, which fact is probably accounted for by the position of the hills. Ghastoi, rising to 8,000 feet, is isolated and has only lower hills near it; whereas Shingarh rises to 9,000 feet, and is parallel with, and at no great distance from, the Kaisar Suleiman Takht range, which being the highest in that part of the country, over 11,000 feet, catches the rain clouds, and doubtless a portion of the moisture reaches Shingarh."

Besides the above, the slopes of the Suleiman Takht are reported to be well wooded with what are said to be deodar, blue pine, *Pinus Gerardiana* and some juniper. It is rather disappointing to find that the Deputy Conservator's proposals to extend the Regulation at any rate to the olive forests near Fort Sandeman has met with no remark either from the Agent or from the Government of India. So, too, no remarks are made on the general question of the extension of the State forests area in Baluchistan, regarding which Mr. Elliott says:—

"Referring to the general question of extending the State forest area in Baluchistan, it must be remembered that as long as there are any trees outside the State forests, the people will cut those trees, and there is no demand for the produce of the State forests, so that every new forest reserved means an addition to the expenditure, for pay of establishment, without any corresponding increase in revenue. The fact, therefore, has to be

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'faced that the department must work at a loss for some years, :
'that probably the deficits in the immediate future may be grea.
'even than in the past.

'It is probable that the juniper has been overrated, and too
'high an estimate formed both of its present and future value.
'The juniper is not a good firewood, as it burns too fast and does
'not retain heat; the charcoal is also poor. As a building timber
'it is very unsatisfactory; knots and holes ruin even logs that out-
'wardly appear sound. The value of the tree lies chiefly in its
'covering the ground, and forming humus, which will prepare the
'way for more useful trees.

'The policy to be pursued now is to protect strictly; the
'shrub jungle increases rapidly under conservancy; many of the
'bushes yield a good fuel, and when the ground has become fairly
'covered with shrubs, it will be possible to establish an advance
'growth of some better forest tree than juniper, and eventually to
'cut out the brushwood, which will yield a good revenue. Whether
'juniper grown under better conditions of protection from man
'and beast, of improved soil, and aided by a thick undergrowth of
'shrubs, will prove a more valuable timber than it is at present,
'is a question which cannot be settled for some time; probably it
'will improve, for selected pieces of mature wood are heavy, strong
'and durable. The substitution of good hardwood trees for juniper
'is however the object to be kept in view. The indigenous
'pistacio and fraxinus must be encouraged; and the introduction
'of *Robinia pseudo-acacia* on a large scale seems to offer the best
'hope and success with non-indigenous species."

We notice, however, that the Agent has called for a re-sub-
mission of the question of the reservation of the Torshor forest,
which the Revenue Commissioner had negatived "on the grounds
'that the forest would not pay expenses, and that it was protected
'from damage by its distance from Quetta" on which the Deputy
Conservator had remarked that if such reasons were expressed
there would be hardly any State forests in Baluchistan.

Mr. Elliott mentions, as one of the arguments for the reserva-
tion of the olive forests near Fort Sandeman that the "charcoal
'supplied to the Commissariat was made by setting fire to green
'Olive trees and picking out any bits of charcoal that might remain
'in the ashes." We thought the ordinary Indian practice of burn-
ing wood in a pit and then picking out such pieces of charcoal
as could be found was pretty bad, but this beats it completely.

The financial results of the year were :—

Revenue	...	...	Rs.	19,037
Expenditure	...	...	"	55,626
Deficit	...	...	"	26,701

which is a falling off on the previous year.

'Studies in Forestry'

This work consists of short series of lectures arranged so as to form a handbook of British Forestry, and as such it will prove of considerable value to those in charge of woodlands in Great Britain, who have, apparently for the most part, never received any technical training, having acquired such knowledge of forestry as they possess by experience, purchased presumably at the expense of their employers and amplified by the very few books available in their native language. The opening chapter is devoted to a consideration of the position as regards forestry in Great Britain. The value of State and Private forests is calculated, and it is asserted that while Government acknowledge the importance of technical training, they go no further in the matter than to appoint commissions of enquiry whose recommendations, even when of the most modest, are not attended to. It is also shown that the arrangement made for training Indian Forest Officers at Coopers' Hill College so improved the financial condition of that Institution that the annual deficit became a surplus, proving that the charge to an individual for the only technical training in forestry to be had in Great Britain is excessive, even if it were not a matter of common sense to perceive that the classes in England, who wish to profit by such training, are not in a position to disburse the £700 or £800 necessary to defray the cost of the 3 years' training. The author concludes the chapter by suggesting, as is only fair, a remedy for the present state of affairs, whereby at a cost of about three-quarter pence per acre for the area under timber, on the system adopted at educational centres on the Continent, the United Kingdom might be provided with the best educational advantages in forestry open to all at a small cost. We can only hope that this suggestion will in time become an accomplished fact, so that the reproach may be removed which at present rests on England as a nation, in regard to its apathy and ignorance in matters sylvicultural.

The remaining 13 chapters of the book lead the reader simply and progressively, after briefly describing the British Sylva, to a position whence he should be prepared, in any given circumstances, to decide what species to cultivate, how to form his woodland crops, how to tend them when he has them, how to manage them in the most paying manner and how to regenerate them when the necessity arises. The two last chapters are devoted to a consideration of some diseases of trees and of a few of their insect enemies.

To those who are unable to refer to the standard German works on the subject touched in this book, Mr. Nisbet's 'Forest Studies', will be valuable. And those who can do so may yet be glad to have the opinions of the greatest authorities in silviculture, and some results of their observations collected in a

concise and convenient form. *It is not supposed that the author* lays claims to any originality of research in regard to British sylviculture, the fact of his belonging to the Indian service would preclude the possibility of continuous practical study of forestry in Europe, so that while acknowledging the value of this work to the British forester, we can only selfishly regret that the studies in forestry were not the outcome of Mr. Nisbet's knowledge applied to the Sylva of India.

Field and Garden Crops.

We have received from the Director of the Botanical Dept. in Northern India a copy of Part III of his Field and Garden Crops of the North-Western Provinces and Oudh. The first two parts dealt with the principal food crops and the vegetables, and the present one completes the work with descriptions of the miscellaneous food plants and food adjuncts. Plates are given of all the species described, and the descriptions give the chief items of information regarding them. In some of the plates the dissections are not very good : witness the section of a *brinjâl* in plate 95, but the figures themselves are excellent. The work, as a whole, is an invaluable one to those who wish to study the various crops of different plants of Northern India, and to know something of our common native vegetables ; and we congratulate Mr. J. F. Duthie on its successful completion.

VI.—EXTRACTS, NOTES AND QUERIES.

The Physical Test for Candidates for Coopers Hill.

Many of our readers will be amused at the following extracts of letters received by a correspondent from a candidate for the recent examination of the Forest Department through Coopers Hill:—

“ On June 22nd we had to be at the India Office at 11. A. M. to meet the Professor of Forestry; and the Medical Board sat at 1 P. M., but we were not allowed to leave as soon as examined. We had to wait till all had been examined, and the Professor told us the result collectively. Of those, 26 in number, who were examined on Friday (23rd July) none failed. Thirteen were examined on Tuesday, and of those one or two failed. Altogether there are 39 up this time. One at any rate was ploughed in the Medical, and perhaps two in the Physical, as they were not present at the end when their names were read out.

"I am just back from the Physical. I got along splendidly, 'no blisters or split nails or skinned feet, though the soles of my 'feet were a little sore owing to the hard ground. A profes- 'sional walker came with us this year, and I think this was the rea- 'son that he took us faster than last time, when one of the professors 'came too. We did the first twelve miles in 2 hours and ten minutes. 'then stopped for lunch, and started again at a quarter past one, 'getting back to Jack Straw's Castle by a quarter past four. The 24 'miles took altogether 5 hours, 10 minutes, a pretty smart pace at any 'time. It had been a hot day, but a breeze has, luckily for us, been 'blowing all day. We had to get over innumerable stiles, and at 'each there was a rush to see who could get over first. It was a 'very foolish proceeding, but I had to do the same, or else be left a 'good way behind. I felt quite fresh for the first twenty miles, 'but after that began to feel it a little, but I was not nearly so tired 'as last year. Towards the end I felt cramp coming on, and 'was just deliberating whether I should fall back a bit and rub 'my leg when some one else very kindly obliged me by taking it. 'This necessitated a stop, of which I took full advantage by rub- 'bing my legs. He had taken it pretty badly, and the profes- 'sional took 5 minutes to rub it out of his leg. When two miles 'from home a second fellow took it very badly, and though he 'was soon able to walk on, he felt his legs very painful. These 'two stops helped many of us, and I came in at the end compara- 'tively fresh. After a wash up I felt all right, and not very stiff, 'Then we had tea, and that was the end."

Kamela Powder.

It does not seem to be generally known that this powder which is usually obtained dry by rubbing it off the capsules of *Mallotus philippinensis*, can also be obtained by a wet process; and that the extract is commonly prepared in the Dún. In the wet process, the capsules are put into a tub of water, which water is then stirred vigorously, and the sediment containing the dye is then taken off and made into rough cakes. A large proportion of the colouring matter would seem, however, to remain in solution in the water which is thrown away. The cake extract, however, is scarcely used as a dye, but as an application in cutaneous diseases, and also for piles.

An experiment made by Pandit Sadanand, Extra Assistant Conservator of Forests, shewed that 40 lbs. of the fruit gave 6·6 oz. of extract, which is not bad, considering that it is only the powder on the outside of the capsules that is of any use. This is almost equivalent to saying that it takes 100 lbs. of the capsules to give 1lb. of the extract. A market for Kamela, of which the Dún can produce a large quantity, is much wanted.

The Gigantic Swallow-Wort.

The gigantic swallow-wort (*Calotropis gigantea*) is a shrub of two varieties, the only difference between them consisting in the colour of their flowers. It is commonly to be found in waste ground among rubbish, in ruins, and such like places. But the plant has gained much prominence from the many and important uses to which it may be applied. An acrid, milky juice flows from every part of the shrub when wounded, and this the natives use medicinally in different ways, besides prescribing preparations of the plant itself in epilepsy, paralysis, bites of poisonous animals, as a vermifuge, &c. In almost all cutaneous affections it is frequently employed, but its virtues have been largely tried in the cure of leprosy. The root, bark, and inspissated juice are used as powerful alteratives and purgatives. The activity of this drug is said to be owing to a principle called Mudarine, discovered by Dr. Duncan, of Edinburgh, who found the juice to possess the singular property of congealing by heat and becoming fluid again on exposure to cold. Mudarine is obtained from the tincture of Mudar, the powdered root being macerated and steeped in cold rectified spirit. After recovering the spirit by distillation, the solution is allowed to cool. A granular resin is then deposited, which is allowed to dry in order that it may concrete. If water be then applied the coloured solution from which the resin was deposited dissolves, and the resin remains. This solution is called Mudarine. In taste it is very bitter, soluble in alcohol and cold water, but insoluble in sulphuric ether or olive oil. By experiments made by Dr. J. Playfair the milky juice was found to be a very efficacious medicine in leprosy, dropsy, rheumatism, and in hectic and intermittent fevers. By the Hindoos it is employed in typhus fever and syphilitic complaints with such success as to have earned the title of vegetable mercury. Dr. Duncan held that it agreed in every respect with Ipecacuanha, and that from the facility of procuring it, it might eventually supersede the latter medicine. The pulverised root made into an ointment is a very efficacious remedy for old ulcers. The milky juice mixed with common salt is administered in cases of toothache, and the juice of the young buds in ear-ache. The leaves beaten up with pepper are given internally in cases of snake-bite, and boiled in oil they are rubbed over the body in scabies. Besides its medicinal uses, the plant and its products are utilized in various other ways. The root is used in the manufacture of gunpowder charcoal. In a powdered form it is used to adulterate safflower. The silky floss which surrounds the seeds has been woven into shawls and handkerchiefs, and even made into paper.

But the chief value of this plant consists in the fine, strong fibres in which it abounds. To procure them the straightest

branches are cut and exposed to the air for at least twenty-four hours ; on the second and third day they are slightly beaten ; the skin is then peeled, and the stringy substance between the bark and the wood taken out. The fibre is then dried in the sun. This slow process is necessarily expensive, but if the bark is steeped in water, it discolours the fibre. This fibre is, however, strong, and possesses many of the properties of Europe flax. It can be spun into the finest thread for sewing or weaving cloth. It resists moisture for a long time. From experiments made its tenacity as compared with other Indian fibres is as follows :—

Breaking weights.

	lbs.
Gigantic Swallow-wort (<i>Calotropis gigantea</i>)	... 552
Sunn (<i>Crotalaria juncea</i>)	... 407
American Aloes (<i>Agave americana</i>)	... 360
Cotton (<i>Gossypium herbaceum</i>)	... 346
Bowstring hemp (<i>Sansevieria zeylanica</i>)	... 316
Deccanee Hemp (<i>Hibiscus cannabinus</i>)	... 290
Coir (<i>Cocos nucifera</i>)	... 224

The fibre of the gigantic swallow-wort is thus very strong. But it is too valuable for ordinary cordage. It is said by good judges to be better suited for the manufacture of cloth than for cordage purposes. It is much used in India for bow-strings, ropes, bird-nets, and tiger-traps. The fibre has never, however, been cultivated as a cordage plant. It was once described as much resembling Belgian flax, well suited for prime warp yarns and worth £100 per ton. Royle says that it yields a kind of manna called Mudar-sugar. The viscid juice of the plant has been successfully converted into rubber in Madras. To prepare it, the juice is evaporated in a shallow dish, either in the sun or in the shade. When dry, it is worked up in hot water with a wooden kneader. It is soluble in oil of turpentine, takes impressions, and should prove a valuable product, either alone or mixed with other substances. It is strange that this handy plant with its various uses is not more widely cultivated in this country.

The Woods of Tasmania.

At a meeting of the foreign and colonial section of the Society of Arts, a paper was read by Mr. G. Colling Levey on "Tasmania and the forthcoming Hobart International Exhibition, 1894-95." The lecturer said that although so near Australia, and possessing, with a few additions, the same flora and fauna, the aspects of the two countries were entirely different. The length of

Tasmania was 210 miles, its greatest breadth 200 miles, and its area about 24,330 square miles. The interior combined the climate of Brittany or Cornwall, but without their humidity, the beauty of the Apennines, and the fertility of England. The leading productive industry of the colony was mining, but its mineral wealth was only partially developed. There were three great sources of wealth which up to the present time were undeveloped. There was no reason why the ornamental woods—the blackwood, the Huon and King William pines, and the myrtle, might not be largely employed in England for furniture, or why the hard woods, such as the red gum and the box, should not be employed for street paving.

In order to secure a thorough trial in England of Tasmanian hardwood for use as blocks for street paving, the Government of Tasmania offers to assist the timber merchants of the colony in forwarding a trial shipment of timber sufficient to cut about 10,000 blocks, and to be disposed of in England on the most favourable terms obtainable for laying down in the streets of London or some important provincial town. If five timber merchants in Hobart will each contribute 9 in. by 3 in. timber in planks equal to 2,000 5 in. blocks, delivered at the Hobart Wharf, the Government is prepared to pay freight on the same and all incidental charges in England. It is proposed to consign the shipment to the Agent-General. It is anticipated, that if not a remunerative price, at least a large proportion of the shipment may be recovered by the sale of the timber, and any such return, the Government proposes, shall be divided *pro rata*, according to the expenses to the colony and to those who supply the blocks. Should it be expedient to give the consignment away to leading municipal authorities, so as to secure a trial and advertisement for Tasmanian timber, merchants will lose the cost of their several contributions, and the Government the amount paid for freight and other charges. (*Timber Trades Journal*).

The Brandis Prize.

The awards of the Brandis Prize for 1893 have been made as follows:—

To Babu Upendranath Kanjilal, for paper on the cultivation of the Date Palm.	Rs. 50
To E. M. Buchanan for article on the Andamans.	„ 35
To Mian Moti Singh for article on Deodar in Kulu.	„ 35

Forester and Lumberman in the Adirondacks, by Gifford Pinchot.

A tree in the virgin forest of the Adirondacks which has reached its full height has had an extremely interesting struggle for life. It exists as a survivor, having outgrown and overcome very many competitors, most of which have died and disappeared. After it has secured its place as an adult member of the forest, the tree bears seed from time to time, the seed germinates, and the generations of seedlings grow for a while in its shade, and then perish successively for want of light. Finally, the parent tree passes into old age, becomes unsound, and falls, and the young seedlings which happen to be under it at the moment, or which appear after a time about its roots, spring up under the influence of the light which the old tree no longer intercepts, and the struggle for supremacy is repeated by the younger generation until one or more of them takes its place among the grown trees of the forest.

So through the life and death of millions upon millions of individuals the life of the Adirondack forest has gone on for centuries unbroken. Nor is its continuance endangered even by the severest accidents, unless man interferes. If a windfall happens to make a break in the forest cover, or if fire destroys it over a certain area, a different process takes place; but nature provides, nevertheless, for the continued life of the forest. Where the openings is made in the forest cover the vegetation at first is composed of plants peculiarly suited to the new conditions, such as grasses and briers. The first trees which appear—generally poplars and fire cherry—come up because they are specially fitted to overcome the enemies and hardships which meet them in the "slash." Then, when they have prepared the right surroundings of soil and shade, the old kinds—spruce and maple and beech, or whatever they may have been—come gradually back, and after a time the forest is restored as it was before the interruption. Such a process is an exceedingly long one; for nature is as indifferent to the length of time over which her operations extend as she is to the life of the individual. It is only the life of forest itself which, in the long run, she effectually protects and sustains. But it is the regular cycle of growth which is of greatest interest to the forester, because from it he derives his own method of handling the forest.

If, then, we consider the life history of the forest untouched by windfall or fire, we find the same prodigality of time, and, from the standpoint of our needs, a very great loss of timber. In order to give the forest its true place as a permanent resource, we must adapt the natural process of the endless birth and death

of the trees to the uses of man, to whom time is of the first importance and timber a very valuable commodity. This is the province of the forester. But in his attempt to preserve the forest by making it useful, the forester is necessarily met by many limitations, chief among which is always the nature of the return which the forest must be made to yield. The first and most important restriction in the Adirondacks is, consequently, that which is imposed by the merchantable value of the different trees.

Speaking roughly, at the present time only the softwoods in the New York wilderness have a merchantable value, and consequently they alone can be cut by either the forester or the lumberman. We must therefore leave out of consideration the hardwood trees as a forest product, and speak only of the others. We have seen that nature makes room for young trees by the decay and fall of the old tree which has long outlived its prime, and has for years been appropriating to small purpose the space and light, by the help of which a younger generation might have been developing into the raw material of valuable lumber. Nature's object—the continued life of the forest—is secured, but there is a serious loss of time and timber, from the human point of view. On the other hand, the forester takes each tree both when its useful qualities are in their prime and when there is young growth of valuable species under it to take its place. The cutting itself is done in such a way that the young trees, on which the future usefulness of the forest depends, are injured much less than under nature's method, because the direction in which the tree is thrown is not left to the wind or to some other chance, and because the top is not allowed to injure permanently the young trees upon which it may have fallen. The dense cover which gives the forest its value as far as the water supply is concerned, is preserved with the greatest care. It may be noted here that the removal of the trunks of the trees so that they do not rot on the ground has comparatively little to do with the value of the forest floor as a factor in the water supply. It is the twigs and leaves, and more especially the latter, whose annual fall and decomposition are of most value to the floor—far more, both chemically and mechanically, than the fall of the whole tree once in two or three centuries.

The fundamental difference between the policy of the lumberman and the forester in the Adirondacks, or elsewhere, is in the attitude of each towards the future. In both cases it is the natural result of previous training and experience, and as such each opinion is entitled to consideration. It is only when the practical effect of the two policies on the general welfare becomes manifest that we are justified in preferring the one to the other. The lumberman, with the present alone in mind, cuts and markets all he can profitably handle, with little reference to the effect of his action on

the future supply of lumber. The forester, whose conception of the forest may be somewhat illogically described as that of an endless succession of second growths, works from a different starting-point. His object is to draw from the forest the largest return which it can be made to yield without endangering its general value to the public, and with the express condition that its productive capacity for the future shall not be diminished, but increased. While the lumberman cuts all that he can market, the forester cuts only those trees which, for the welfare of the forest itself as well as for the product to be had from them, ought to be removed, and does it in a way to do the rest of the forest, and especially the young growth, the least possible injury.

Divergent as these two methods may seem in the probable money result, there is one peculiarity of the Adirondacks which will enable the forester, even at first, to make but a slightly lower money return than the lumberman, and after a comparatively short interval, as time must be reckoned in the forest, to surpass him altogether. This is the fact that the merchantable softwood trees form only a small proportion of the forest (probably not over 5 per cent.), and are scattered by single trees or small groups through a vast body of unmerchantable hardwood timber. Lumberman and forester are, therefore, both compelled to go long distances for their timber, and to take only a tree here and there. At first the forester would cut somewhat fewer trees than the lumberman, and it would cost him a very small percentage more to get his logs from the stump to the mill, on account of the care he would use not to damage the future forest. But the money advantage which lies with the lumberman in this view of the case is small at the best, and as soon as even the nearer future comes into consideration it disappears altogether. After the first two or three cuts on the same ground the balance must begin to lean to the other side, simply because the forester is actively concerned in keeping up the proportion of the valuable species, while the lumberman, whose interest in the land he cuts over is generally a short one, has seldom any reason for considering its future value. For example, it is sufficiently obvious that if, in a stream which contains a few trout and a great many pickerel, the trout are systematically caught out at the time when they reach the spawning age, and the pickerel systematically left alone, there will soon be no more trout. In the same way the spruce in the Adirondacks, whose struggle for existence against the broad-leaf trees is even now a hard one, as its small proportion in the mixture testifies, will inevitably disappear if it is steadily cut with no regard for its renewal. The fact that in many instances several cuts of spruce timber have been taken from the same ground at intervals of from fifteen to thirty years is no answer to this statement, because a generation in the life of the spruce has not passed since the first cutting was done, and the

crop for the second and third cutting was already on the ground at the time of the first one. I studied for several weeks the handling of a forest in Switzerland which was once composed almost entirely of coniferous trees, whose character was so changed by the long-continued demand for soft lumber that now the conifers form only about the same proportion that they do in the Adirondacks. And even this proportion is only maintained by constant planting—a method of renewing the spruce in the North Woods which would be wholly out of the question on account of the expense, even if it were not entirely unnecessary. What will be the result of a continued drain on the softwood trees in a forest which begins with only this small proportion of them, and where no care is exercised to maintain their number, is perfectly clear. And with the disappearance of the spruce the chance of a revenue from the State forest for a long time to come must also disappear.

Nor are the advantages of forest management by any means limited to the future. Its bearing on questions of vital present importance is at least equally strong. Take, for instance, the question of fire. In the virgin or lumbered forest of the North Woods fires are, in general, of serious danger only on land which has much more pine or spruce than is usual. The pulp industry, the hunter, the small farmer, and, more than any other, the charcoal-burner, are mainly responsible for fires in the wilderness. But, with this limitation in mind, it is still true that fires are less apt to occur under the régime of the forester than under that of the lumberman. However earnestly the latter may attempt to guard against them in certain cases, his efforts, from the very nature of his position, cannot be as farsighted and continuous as those of the forester, nor can he afford to overlook the expense, however slight, which such efforts involve. Nothing so quickly destroys the value of a forest to the water supply as fire; and conversely, nothing protects the sources of the streams so well as dense forest. Forest management, one of whose prime objects is to keep the forest cover intact and the floor in good condition, is therefore a safeguard to the usefulness of the North Woods in their capacity as protectors and equalizers of the water supply. Whether or not this is their most important service to the public, there is certainly no other to which the public attention has been more often and more urgently called. In a word, as against the serious disadvantages I have named, the single point which may be advanced in favor of lumbering on land in the North Woods held or controlled by the State, when compared with forest management, is that of a somewhat larger immediate profit, although at the cost of much greater future returns. Whatever weight such consideration may rightly have with private owners, it is precisely that one which the State, as the perpetual owner of forest land, is bound by every consideration of justice and foresight to disregard.

Enough has been said to make it clear that in my conception the harm which lumbering does, from the standpoint of forest preservation, arises as a consequence of the way in which the lumberman regards the forest. It is the natural and reasonable result of his training, and no more to be decried as inordinate greed than the attitude of the ranchman toward his cattle, or the mine-owner toward his mine. The fault is not with the lumberman, but with the body politic, which fails to use the means of forest preservation which it has at hand. Nevertheless, we have seen that, for the best interest of the general good, to lumber the Adirondacks is not the best way to treat them. To restrict the lumbering to trees of a definite size is doubtless better than to lumber without restriction, but the objections which apply to ordinary lumbering apply here also, although perhaps not in the same degree. The twelve-inch limit fixed by the law of New York for certain cases is an instance in point. (It should be said that, in practice, this limit is really not restriction at all. It is not at all unusual for lumber companies who own their land to restrict cutting to trees twelve inches in diameter. The lumberman who simply buys stumpage on State land naturally confines himself to the larger trees, because, while he pays for all his logs at the same rate per thousand feet, board measure, the same amount of lumber is worth more to him in large logs than in small ones.) As regards the effect upon the forest of lumbering restricted to trees of twelve inches, or any other minimum diameter, it does not, in the first place, provide for proper precautions in favor of the young growth. In a forest of very different character in North Carolina I have found by practical experience that a difference of at least ninety-five per cent. was made in the condition of the dense young growth after cutting the old trees by taking certain precautions which did not increase the cost of felling and handling more than two or three per cent. This work, it may be noted, was done under my direction by a young Adirondack lumberman. In the second place, the twelve-inch rule allows the lumberman to cut many trees which, for the good of the forest, should be allowed to remain. A tree is not ready to be taken, from the forester's point of view, simply because it has reached a certain size, but because, having reached a merchantable size, the interest of the forest as well as the interest of the revenue, demands its removal, and because provision has been made to have its place taken by other trees of the same or of equally valuable species. The continued removal of the softwood trees, which form but a small proportion of the growth, without special precautions in their favor, would, as we have already seen, eventually lead to their practical extinction from the Adirondack forest, and with it too the disappearance of the largest source of revenue which the State can draw from them until the distant time when it will pay to handle the hardwoods.

But while these fundamental differences between the work of the forester and the lumberman exist and determine their whole relation to the forest so long as they act separately, it does not by any means follow that the preservation of the forests can be attained without the lumberman's assistance. Effective forest preservation can only come through the co-operation of the practical lumberman. The language of forest reform in his country has generally been of such a character as to lead to the inference that the forester and the lumberman have nothing in common, and that with the advent of the forester the lumberman must inevitably go. I conceive the facts in the case to point to a very different conclusion. The mechanical ingenuity of American lumbermen, acting through many years, has developed for each part of the country a system of handling timber which we are safe in assuming as perhaps the most efficient and economical that the given circumstances will allow. The forester, from the necessity of the case, has an understanding of the forest from another side. His knowledge of the best way to handle forest land for the production of timber through an indefinite series of years, of the conditions which affect the reproduction of various trees, and of the position of the forest in the general economy, and his special training in other matters pertaining to the woods, all touch on points which the lumberman has not felt the need of knowing, and consequently has never learned. But as soon as the forester begins practical operations, unless he is also a practical lumberman (a combination which I never happened to meet or hear of), he is simply compelled to go to the lumberman for help. The division of labor which has developed itself in practice in my own work in North Carolina is as follow:—The preparation of the general plan devolved upon the forester, as well as the decision as to the location and amount of each year's cut. He was responsible for the selection of trees to fall, although a considerable part of the marking was done by the lumberman according to his instructions, and the general oversight of the whole operation fell upon him much as it does upon the general superintendent of a lumber company. The lumberman, on the other hand, who was born and bred and trained in the North Woods, had largely the same kind of work and responsibility that would have fallen to him had he remained in charge of a camp at home. He had to look out and build roads; see that the draught animals, tools, and the whole force in general, were in good working order; inspect the felling, and see that it was done in accordance with the instructions of the forester, and with as little damage to the young growth as possible; see that the logs were properly put up and scaled; inspect and control the saw mill, and, in brief, take direct charge of the practical operations.

The advantages of such an arrangement are obvious, but they are only to be realized when, as in the case just cited, the lumber-

man has received training enough in forestry to allow him to grasp and adopt the spirit of forest management. Once this is accomplished,—and, to judge from my own experience, the time required is not long, nor is it altogether a loss as regards the current work of the forest,—the efficiency of both lumberman and forester is greatly increased. The forester is relieved of a mass of detail which is peculiarly burdensome because outside of his special training, and so may devote himself fully to the larger questions which he alone can decide, secure in the knowledge that his instructions are being strictly and understandingly carried out. The practical skill of the lumberman, on the other hand, becomes available for the benefit of the forest in a way that was impossible before, while the business success of the work is almost entirely in his hands. The success of the technical details rests upon his intelligence and fidelity in a degree scarcely less marked. In a word, forest management in the United States is only a little less dependent for its success in practice upon the lumberman who carries out instructions than upon the forester who gives them.

In conclusion, then, it may be said that for many reasons the Adirondacks are peculiarly well suited to forest management. The soil is excellent, from the standpoint of tree growth, but of little value for any other purpose. The young growth of the valuable species of trees, with the single important exception of white pine, is always sufficiently, and often exceedingly, abundant. The small proportion of the valuable softwood trees makes it possible for forest management to yield, from the very start, almost as large a return in money as lumbering; and, as we have seen, the balance must change soon and permanently to the other side. The great interests which are involved in the maintenance of the water supply are fully protected under forest management, which is not the case under any form of lumbering, however restricted in the size of the trees which may be cut. The protection of fish and game falls naturally to the forester, whose training and traditions both fit him peculiarly for such work. In all countries where forestry has become established, the functions of forester and game warden are combined. Finally the general character and very uniform composition of the North Woods are admirably adapted to the operations of forest management. In other words, nature's process of handling the forest, which must guide the forester and dictate his methods, needs very little change to respond completely to all the different demands which, as a civilized community, we can make upon the Adirondacks. There is no forest of equal area in this country from the management of which more useful, more immediate, or more lasting and assured results can be obtained.—(*Publications of the Massachusetts Society for promoting Agriculture*)

VII.—TIMBER AND PRODUCE TRADE.

Churchill and Sim's Circular.

5th July 1894.

EAST INDIA TEAK. The deliveries for the first half of this year amount to 6,051 loads, against 6,564 loads for the first half of 1893; and in June this year 740 loads against 1,257 loads in June 1893. The market has shown some tendency towards local improvement, stocks continuing moderate and floating cargoes still being disposed of well ahead.

ROSEWOOD.—Stocks are sufficient for the present limited demand.

SATINWOOD.—Finely figured logs would sell well, but plain wood is not wanted.

EBONY.—Really good logs, in small parcels, would command fair prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to £16
Satinwood	per foot superficial	6d.	to 12d.
Rosewood	„ ton	£5.	to £8
Ebony	„ ton	£6.	to £8

MARKET RATES OF PRODUCTS.

(Tropical Agriculturist, July 1894.)

Cardamoms,	per lb.	2s.	to 2s.6d.
Croton seeds	per cwt.	20s.	to 27s.6d.
Cutch	„	20s.	to 32s.
Gum Arabic, Madras	„	15s.	to 30s.
Gum Kino	„	£15	to £18
India Rubber, Assam	per lb.	1s.7d.	to 2s.2d.
„ „ Burma	„	1s.7d.	to 2s.
Myrabolams, Bombay	per cwt	8s.	to 10s.
„ „	„	4s.	to 4s.6d.
„ „ Godavari	„	6s. 3d.	to 7s.
Nux Vomica, good	„	6s.	to 10s.
Orchella, Ceylon	„	15s.	to 22s.
Redwood	per ton	£3.10s.	to £4
Sandalwood, logs	„	£35	to £55
„ „ chips	„	£9	to £30

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A Note on Sandalwood

By

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CONSERVATOR OF FORESTS IN JAVA.

Sandalwood is the product of various species of the genera *Santalum*, L. and *Fusanus*, R. BR., which both belong to the family of the SANTALACEÆ. The most important of these two genera is *Santalum*, of which some 20 different kinds are known to be indigenous in Asia Australia and Polynesia. Towards the east, *S. insulare* is found in Tahiti and the Marquesas group, and is locally known as "eai." The most southerly is *S. Cunninghamii*, found in New Zealand, and locally known as "Mairi." In the Sandwich Islands, and generally in the north, *S. pyrularium* and *S. Freycinetianum*, Gaud, are most common, both called by the Aborigines "lanala." Towards the west, and especially in India, *S. album* is most frequently met with. Dr. Seemann discovered in the Fiji Islands a very valuable sandalwood tree, called by him *S. Yasi*, but this tree is already nearly extinct in consequence of unrestricted fellings. In New Caledonia, *S. Lomei* and *S. Austrocaledonicum* are found, but these, from the same reason, are now scarce, although lately plantations have been formed in French territory. The wood of *S. latifolium*, *Fusanus spicatus* and *F. acuminatus* is exported from S. W. Australia to England, as is also a so-called sandalwood from Queensland, the product of *Eremophila Mitchelli* of the family *Myoporinæ*. These woods possess only a weak scent and are chiefly used in carpentry and joinery; the wood of *S. myrtifolium*, Roxb*, from Java and Coromandel has also little value. From Zanzibar small blocks of sandalwood are exported, and also from Venezuela sandalwood is sent to Germany, but the botanical origin of these woods is unknown, the former probably comes from the French station of Nossi-bé.

* Included under *S. album* in the "Flora of Br. India."—HON. ED.

Before the middle of the 18th century, India was the only country which exported sandalwood, but since its discovery in the islands of the Pacific Ocean, the largest quantities have been procured from thence, so that many of the local chieftains enriched themselves by this commerce; for instance the chief of Hawaii in the Sandwich Islands is supposed to have derived an income of some £60,000 annually by the sale of sandalwood in the commencement of the present century. But the supply of sandalwood from the islands of the Pacific is now almost exhausted, and Australia hoped to occupy the market once entirely in the possession of Polynesia. In 1884, the export of the wood from Australia rose to 2,620 tons, the product chiefly of *Fusanus acuminatus*, but the prices ruled low, on an average only £8 a ton, whereas the price of the best sandal in China rises from £12 to £40 per ton.

In Europe and North America sandalwood is used for making objects of art and luxury, whilst sandal oil is employed in perfumery and for medicinal purposes. Its use in medicine has much increased during the last few years, and large quantities of wood are now required to furnish the oil which is employed successfully in those cases where the balsam of copaiba was formerly considered to be a specific. In the trade, three kinds are distinguished, East Indian, Macassar and West Indian. The first is a product of *S. album*, the second probably from a closely allied species, and the third from the pseudo-sandal of Venezuela, which has been before mentioned. This so-called sandalwood is exported chiefly from Puerto Caballo, where it is called "*bucita capitala*," but the scent both of the wood and of the oil is very different from that of true sandal.

The ether or oil to which is due the scent of sandal is contained in the heartwood and in the largest roots of the tree, whilst the wood of young trees and the sapwood of older specimens is almost without odour. The oil is obtained by distillation from the heartwood and roots. From experiments carried out by the Indian Forest service, one kilo. of wood yields about 16 grm. of oil; and about 5,000 kilos. are annually exported from Bombay.

India is now, as it was formerly, the principal exporter of sandalwood, and the importance of *S. album* is very marked. *S. album* like all other kinds of sandal is found only in a dry hilly country, and when met with in low-lying, damp localities the wood is almost valueless. As a rule, the tree reaches a height of 7 to 8 metres, with a diameter of 25 to 30 c.m., and so soon as the tree has attained these dimensions it should be felled on account of the danger of the heartwood rotting. The principal regions where it flourishes are Mysore, Coimbatore, north and north-west Nilgiris, Salem and Arcot, where it grows up to an

elevation of some 900 metres above sea level. In the Malay Archipelago, *S. album* is only found growing sporadically. In Mysore, sandalwood is a Government monopoly, and the trees may only be felled and sold by special officers, the annual yield being about 900 tons, valued at £30,000. In Madras, where there is no monopoly, the export amounts from 500 to 600 tons annually, the tree being protected and reproduced by rational treatment.

The sandalwood tree is generally felled when about 20 to 25 years old, for experience has shown that at that age the product in oil is the highest; the felling takes place in the winter and the bark is immediately removed, and the limbs cut into logs of about 60 c.m. long; these are then buried in the earth for some months, when the sapwood is removed by the white ants, leaving the heartwood untouched*. This latter is then dug up and dried in special racks for some weeks, great care being taken to prevent splitting. The wood is finally sold at public auction by the officials of the Forest Department, and purchased by merchants from all parts of India. Before the auction sale, however, the wood is sorted into lots according to its colour, the darker the colour the more oil it contains. In trade, red, yellow and white sandal is distinguished, but all three are the product of *S. album*. It is considered that the wood is darkest and densest close to the root, and in consequence the trees are felled as close as possible to the ground. Light yellow pieces of wood and those with much sapwood have little value, the most sought after are specimens of a dark yellow colour, or better still those with reddish brown veins, and further, the wood must be free from flaws, hard, and of fine grain, with an aromatic, slightly bitter, but not unpleasant, taste.

Large pieces of sandalwood are mostly exported to China; smaller to Arabia; medium sized pieces are utilized in India. The yearly import of sandal into China amounts to about 6,000 tons, but only a small proportion of this comes from India. Bombay receives yearly some 700 tons from the Malabar Coast, and re-exports some 450 tons to other countries.

Dr. Hunter pointed out some years ago that sandalwood was especially suited for wood engraving, some blocks having given 20,000 impressions without being materially injured. For this purpose dark colored pieces of about 12 c.m. from trees grown on rocky soil are most suitable.

Finally, it may be noted that the wood of *S. album* is commonly called sandal, when it should be "*Santal*." The Arabic name is "*Santal*," whilst on the Malabar Coast the name "*Chandanacotta*" derived from the Sanscrit, is used. In China, sandal is "*Tan-heong*" or scented wood.—(Translated by S. E.-W.)

* NOTE:—This is not always done. In Nilgiris the sapwood is simply chipped off.—HON. ED.

'East Indian Walnut.'

The following extract gives the answer to a question we once put in this Journal as to the identity of the wood known in the Home market as 'East Indian Walnut.' There is still, however, one little piece of doubt in our mind, and that is whether the *Albizzia*, which gives the 'Koko' of the Andamans, is *A. Lebbek*, or some other species. The *Lebbek* or *Siris* of North India is not a tree which is in any way remarkable for its timber, or even for the beauty of the small amount of heartwood which it possesses, and it seems difficult to understand that the same tree grown in the Andamans gives a valuable, useful and handsome furniture wood. However, there are parallels:—*Odina Wodier*, an ugly softwooded tree in the North, gives in Bengal a pretty red durable wood—heartwood of course—with a much smaller proportion of sapwood; and *Albizzia Lebbek* may do the same.

The woods of all the *Albizzias* are very like each other, differing chiefly in weight and hardness, and if *A. Lebbek* can give a furniture wood, why should not *A. procera*, which is probably much more common, *A. odoratissima*, and the Central Indian *A. Thompsoni* (we wish Sir D. Brandis would publish his new species, which is very common, and which we have met with even in the Siwaliks) do the same, and be equally available for the European trade. We recommend this suggestion to forest officers near the coast, who are in the way of sending home consignments, and we also recommend them to study the question of 'burrs,' and whether it may not be possible to produce them artificially.

"According to the *Calcutta Capital*, the Deputy Conservator of Forests, Andaman Islands, stated, in reply to an official circular, that 'the possibility of creating a regular export trade in East Indian walnut (*Albizzia Lebbek*) from India appears to be well worthy of the consideration of the Forest Department, as well as of timber merchants in Europe and this country.' The wood seasons well, is easily worked and carved, develops a beautiful grain, and is susceptible of a fine polish. Owing to these and other good properties it produces pretty as well as substantial furniture, and the small consignments which have been occasionally sent from the Andamans to London have commanded, for this purpose, a ready sale. In India, it is much used in ornamental carpentry and cabinet-making; and owing to its hardness and fair durability, for sugar-cane crushers, oil-mills, well curbs, wheel work, &c. It is also highly suitable for house-building, although people in the northern provinces have a superstition that it is unlucky applied to this purpose. The 'East India walnut' (not to be confounded with the true walnut of India, *Juglans regia*) is found wild or cultivated in most parts of the empire, Bengal, Bombay, Madras, and Burma. Specimens have been forwarded to the Imperial Institute from the Terai forests

‘ of the Darjeeling District, from Satara, Poona, and other parts of
 ‘ the Western Presidency; from South Arcot, Malabar, &c., in
 ‘ the South; from Thayetmyo in Upper, and Tenasserim in Lower,
 ‘ Burma. The growth of the tree, which is said to attain a height
 ‘ of from 40 to 60 feet, with a girth of 6 to 8, and at times even
 ‘ 10 to 12 feet, is exceedingly rapid. Seventeen-year-old stems
 ‘ have been found in Sukkur, Sindh, to girdle 5 to 6 feet. The
 ‘ former Burmese Government, it is said, thought so highly of the
 ‘ timber (known in their vernacular as “kuk-ko”) that a higher
 ‘ tax was fixed on the felling of it than on that of any other tree.
 ‘ Burrs of the East India walnut, as in the case of other furniture
 ‘ wood, increase in value with the intricacy and rarity of the design
 ‘ and the size of the burr. These are, as a rule, sliced up into
 ‘ veneers, and cost, not uncommonly, 10 to 20 times that of the
 ‘ plain wood; indeed, as high as 100 times the value of the ordin-
 ‘ ary timber has been paid for extremely curious and unique
 ‘ specimens.”—*The Globe*.

The Malabar Steam Sawmills.

Through the courtesy of Mr. H. Brown I was afforded an opportunity of inspecting these interesting works on the 26th July last. The Mills are situated on the banks of the Cullai river, about a mile and a half from Calicut, and close to the Railway bridge over the river. Connecting rails have been laid to the works themselves, so that timber can be shunted in and scantlings removed without difficulty.

Owing to the swampy nature of the soil, it was found necessary to raise the basement some 4 feet above the level of the ground, and on this basement two large open sheds, roofed with patent tiles, have been erected.

The plant consists of an ordinary hand-saw—a patent self-feeding band-saw by Messrs. John A. White and Co., of Dover, New Hampshire, obtained by Mr. Brown during his recent visit to the Chicago World's Fair, and two circular saws—all driven by a very fine 36 horse power engine by Ransome and Sims. I was particularly struck by the performance of the American band-saw which ripped through the hardest woods at a most surprising rate.

I timed its work carefully, and found that it turned out a candy ($66\frac{1}{2}$ suppl. feet.) Malabar measurement, per minute of mango wood. The usual rate for sawing by manual labour in Malabar is 1 rupee per candy.

The whole factory was a model of neatness, and every labour-saving appliance, which the ingenuity of Mr. H. Brown could invent, was there to attest to his great ability.

Work was in full swing when I arrived, and busy gangs of Moplas and Thears were engaged in carrying away and storing the sawn scantlings in the large tiled sheds provided for the purpose. One large shed was almost completely filled with splendid sleepers of Irul (*Xylia dolabriformis*) for the Nilgiri Railway. In another, carpenters were busy finishing off wooden blocks for the Madras Electric Tramway. Enormous piles of planks, etc., lay ready for delivery to the Madras Gun Carriage factory, Mysore Gold Mines, etc., and on every side were evidences of a thriving industry. Mr. Brown appeared to have his hands full, and was working at his utmost speed to comply with the numerous orders with which he seemed to be overwhelmed. This is entirely due to the careful and business-like manner in which he conducts the works, and the universal satisfaction he has given by low prices and good material to his numerous customers. Would there were more like him, for it is to the energy and enterprise of such men that the Forest Department will be in the future indebted for some of its success.

R. M.

On Extending the Culture of Silver Fir in France.

From the Revue des Eaux et Forêts, by Mons. A. D'Arbois de Joubainville

Firewood is gradually being replaced by coal, and as the supply of the former exceeds the demand, its price is steadily diminishing, with the result that the revenue obtained from coppice areas in France has decreased to a serious extent. Proprietors are endeavouring therefore to raise in their forests less firewood and more timber of both leafy and resinous species; and it is the extension of the culture of these latter which seems most urgent, for resinous woods are by far the most abundantly imported for consumption in France, the total value of such woods imported during the period 1881 to 1890 being eighteen hundred million francs.

Scots pine, spruce, larch, Austrian and Corsican pine, pinaster, Weymouth pine and silver fir have already been introduced into the coppices of France, but have produced very little timber. Many of them have died or have been cut before reproducing, and the results on the whole are indifferent. The silver fir, however, which unfortunately had been but sparingly resorted to, has given encouraging results. Below are given some examples:—

The first to be mentioned is a silver fir plantation of about 200 acres obtained from sowings in a beech coppice of the "Bois de la Presse" near Bains in the Vosges, at an altitude of 1,300 feet on soil derived from the decomposition of the variegated sandstone. This plantation is very productive, and regenerates itself

naturally. M. Broillard in his *Traitement des Bois* quotes this as an example to be imitated, and recommends the sowing of silver fir in spring, or at any rate after the fall of the leaves, for buried in these, the germinating plant is unable to force its way through, and dies soon after germination.

M. Broillard adds that in 1861 a similar substitution of species was successfully made in a coppice with standards in the communal forest of Bains similar to the above, and we have seen a work of this kind equally successful not far from there, soil and altitude being practically the same.

In 1762 a forest guard planted a basketful of young silver fir plants in a coppice in Normandy, some leagues to the south of Evreux, at an elevation of 660 ft. In 1840, these plants were 65 feet high, and their girth at 4 feet from the ground varied from 4.8 feet to 8.8 feet, and the seed given by these trees had resulted in an excellent crop of young plants. The silver fir forests of Normandy on a fertile soil at low elevations similar to the above have a very rapid growth, and consequently the wood is soft, a defect which diminishes the value. But as they grow so much quicker than at higher elevations the larger quantity of wood produced compensates in a great measure for its inferior quality and the revenue is greatly superior to that of the coppices. Some 50 years ago, the introduction of conifers was commenced in the coppice areas of the forest of Epinal (Vosges), and of all the species sown the silver fir is the one which has succeeded best, and in fact the only one which seems to have definitely established itself.

Numerous other instances of a similar kind are quoted, where the introduction of silver fir into various coppices of the Vosges has been successful, whereas other conifers have been more or less a failure.

In the State Forest of Verzy (Marne) about forty years ago blanks were sown with Scots pine, Austrian and Corsican pine, pinaster, larch and silver fir. The first did well while young, but have been attacked by disease, and are now anything but promising, all the rest are in a moribund condition, except the silver fir which is growing vigorously, and promises to give good results. The soil on which it is growing is a sandy clay of the lower tertiary, and the elevation is between 900 and 1,000 feet.

In the State Forest of La Manise in a coppice with standards, a plot of about three roods was sown with spruce and silver fir about 54 years ago. These have now attained a height of about 65 feet, whereas the oaks reserved as standards in the coppice round about them are just about half as much. Many of the former have a girth of 5 feet. The silver fir have produced numerous seedlings, whereas the spruce, though they bear cones, have not given any seed. In the adjoining forest of Revin, too, the spruce introduced about the same time have not been a success, they

either get blown down by the wind or die standing, the fungus, *Rhizomorpha subcorticalis*, having attacked and killed most or all of their roots. They are thus gradually disappearing without having reproduced themselves. Subsequently, on the advice of M. Nanquette, silver fir was tried in a blank in this same forest, and is doing very well there. The compartments, in which the above mentioned conifers were sown, are situated at an elevation of 1,300 feet on a deep moist sandy clay soil. In the State Forest of Harquies, not far from the above, on a similar soil, but at a somewhat lower elevation, silver fir and larch were introduced into an oak coppice about 30 years ago, the former are in this case also doing well, whereas the larch, which showed a magnificent growth at the commencement of the period, are now in a hopeless condition.

As far back as 1864 the introduction of silver fir was recommended by M.M. Lanier and Mélard of the Forest Department on the transition rocks of the Ardennes, wherever there was sufficient soil, and this would have embraced the greater part of this region, as it is only on the abrupt slopes formed by faults that the underlying rock is insufficiently covered with soil. Had this been done, there is little doubt that this area would produce vigorous silver fir forest in place of the miserable stunted oak coppice and blanks now to be found there.

In the coppice of the north-east of France, on the plateaux and northern slopes where the soil is deep, this substitution of species would certainly be a success. The cost of such operations would be comparatively small, and in time a very much larger revenue would be obtained from them, not to mention that if these operations were carried out on a large scale France would soon produce enough timber of this class for its consumption, and thus save the enormous sums of money she now pays to obtain it from other countries.

A. F. G.

Prize day at Coopers Hill, 1894.

The annual distribution of prizes at the Royal Indian Engineering College, was held on the 26th July last. The usual gathering of old Anglo-Indians were present, and Lord Reay, in the unavoidable absence of Mr. Fowler, Secretary of State for India, presided over the ceremony. The President, Sir Alexander Taylor, read his annual report on the work done in the past year, ending up, as is his custom, with an anecdote, setting forth the quality of gratitude, on the part of a native, for an act of kindness done to him by an Englishman. Four Fellows of Coopers Hill have been made this year, of whom one, Mr. B. O. Coventry, is a Forest

student or "Gardener," if we use the nickname given to Forest students by their Engineering *confrères*.

The number of students in residence at the beginning of the session (September, 1893) was 106, of whom about 32 were forest students.

The Senior Forest students had been apprenticed in pairs for over 5 months in Germany during the summer of 1894, and after the completion of that period of practical training, had returned to the College to complete the more theoretical part of their training. The students were placed under Prussian officers selected by Sir D. Brandis, and these received the students with much kindness and attention, which was fully appreciated and profited by. The long interruption of their College course, which this procedure necessitated, has proved to be somewhat inconvenient, and in future the students may perhaps be sent to the continent for their practical training after the College course is completed, as is now done in the case of the Engineering students at the College. Sir Alexander then referred to the sad death of Mr. C. C. Abbey, which is already familiar to our readers, speaking of him as a very promising young forester, the second in his year who had had a bright and useful future before him, which was brought to a sad and sudden end by the fall of a tree, blown down as he passed under it, while returning from his work in the forest.

Lord Reay addressed the assembly after the annual report had been read by Sir Alexander Taylor, and advised the Forest students to endeavour to work with the natives of India with whom they were brought in contact, and said that by so doing they would make their work much easier, and would also find the ordinary native, even if he could neither read or write, would be able to give them a great deal of useful information about the nature and character of the forests, near which they lived. He went on to say that if forestry occupied, in England, the position that it ought to, it would not be necessary to send the students to Germany to learn the practical side of the science; but at the same time expressed his gratitude to the German officials who were always glad to welcome pupils from the College and to receive them most hospitably.

The Scholarship of the Vice-President of the Council of India for the best man in Forestry in the work of the first two years, was awarded to W. Mayes.

The following is the list of prizes won by forest students:—

3rd Year.

B. O. Coventry, 1st Prize, Forestry.

H. A. Farrington, 2nd prize, Forestry.

C. H. Tennant, Entomology.

2nd Year.

W. Mayes, 1st prize, Forest Management; Entomology; Botany.

C. M. McCrie, 2nd prize, Forest Management.
1st Year.
W. A. R. Doxat—Sylviculture.
R. S. Hole—Botany.

The following are the names in order of merit of the Forest students who passed out as Assistant Conservators of Forests, 2nd grade, and will reach India next November.

B. O. Coventry, H. E. Bartlett, H. A. Farrington, W. E. Copleston, C. H. Tennant, D. A. Thompson, A. St. V. Beechey, W. W. Batchelor, G. W. A. Grieve, M. Lawson.

C. G. R.

II.—CORRESPONDENCE.

Disease of Cocoanut Trees in Travancore.

SIR,

I shall feel thankful if any of your readers would, suggesting remedies, kindly explain, for the benefit of us Travancoreans, the following interesting yet disastrous phenomenon :—

Quite recently, in the central and northern districts of Travancore, we have lost several beautiful cocoanut trees from decay of the tender, unexpanded leaf shoot. At first, the lower end of the shoot grows discoloured, and, in a few days, general putrefaction of this and more or less of the cabbage ensues ; the shoot droops and, in some cases, falls to the ground ; the tree decays soon after, and we are left lookers-on and losers.

In trying to account for this remarkable disease, we are convinced that it cannot be the work of the Rhinoceros or Longicorn beetle ; for both these depredators bore into the shoot, cabbage or stem of the palm and, by early detection and careful tending, in the majority of cases, death can be stayed. But in the case in hand, the only sign to us of the presence of the disease is the drooping on the tree of the leaf-shoot when, obviously, all our efforts to remedy the evil are ineffectual because too late. The explanation most generally accepted by the natives is that “falling stars” (meteorites, they say) have been at work. Another reason advanced has it that decay is brought about by an exuberance of sap, and that it can be remedied by bleeding the tree. This would at least appear to be plausible, from the fact

that in our very moist climate evaporation is too slow to keep pace with the incessant ascent of water in the stem, and that it is only the moist vigorous trees that are, as a rule, affected; but the remedy is desperate. By a third cause given, the malady is attributed to the attacks of fungi.

With all these explanations, however, the fact remains that we are losing many of our valuable trees without making any attempt, so far as I know, to, if possible, prevent it. The hot weather has been unusually severe with us this year, and the monsoon rains unprecedentedly scanty; but I am not at all certain whether these facts are of themselves sufficient to explain away the very unsatisfactory state of affairs now obtaining in our cocoanut gardens.

A. M. SAWYER.

The Strongest Timber.

SIR,

With reference to your query on the above subject on page 241 of the *Indian Forester* for June, 1894, I send you the following extract, which supplies the information:—"On the other hand this order (Laurineæ) embraces the Bornean iron wood '(*Eusideroxylon Zwageri*), probably the heaviest wood known, and one which alike defies *Teredo* and *Termite*.'"—(Mason on Burma, its People and Productions"—Page 289 Vol II.)

Torngoo,
11th August, 1894 }

W. J. LANE-RYAN.

Denudation of Nilgiri Slopes.

DEAR SIR,

I enclose an extract from the "*Madras Times*" of the 6th instant. This extract, which formed part of the Proceedings of the Nilgiri Planter's Association held on the 4th, is encouraging, as it shows that some planters at least appreciate the benefits of Forest Reservation:—

"*Government Reserves*—Mr. A. G. Nicholson's Resolution was then put to the Meeting: That Government be asked to throw open the reserves for selection for coffee planting as they have done on the Shevaroyes. It was pointed out by Mr. Brodie that though several applications for land had been made by Shevaroy planters, no orders had yet been received from Government. Mr. Hodgson then said that as the terms of the Resolution were too vague to be of any use, and that as he himself was of the opinion that too much land had already been opened for cultiva-

tion in certain districts of the Nilgiris—thus causing, in his opinion, the unsatisfactory change of the seasons in late years—he proposed that the matter be adjourned to the next meeting. Mr. Grey moved an amendment to the effect that the whole matter be dropped *sine die*, as in his opinion there was already too much coffee on the Nilgiris, and not enough labour or manure to provide for the present needs. After some laughter, this amendment was dropped and Mr. Hodgson's carried."

A great deal of damage has already been done by the denudation of steep slopes on the Nilgiris, *e.g.*, the Coonoor Ghaut, and what is now required is the strict conservation of the woodlands still unreserved.

R. M.

Flowering of Bamboo in Coimbatore.

DEAR SIR,

In accordance with instructions received from the Conservator of Forests, I have to report that nearly all the bamboos (*Dendrocalamus strictus*) in the Pollachi Range of this Division flowered and seeded this year. The Range comprises the outer slopes of the Anaimalai Hills, and the forests situated at the foot of these hills in the Pollachi Taluk. The flowering and seeding of bamboos did not extend to the Tunacadavu Range, which adjoins the Pollachi Range, and is situated on the Anaimalai Hills. I observe that the teak in both these Ranges is flowering profusely, and I think that a good seed year may be expected.

H. B. BRYANT.

Collection of Hirda Fruit in Satara.

SIR,

As promised some time ago I send you a total return of the dry Hirda as sold from our Dépôts since 1888-89; if you add 20% for dryage the original collection of green Hirda will be approximately obtained. The "kandy" mentioned, when dry measure is taken, weighs 1,920 lbs. as nearly as possible. 20 mds. or 240 pails = 1 kandy.

			kdy.	mds.	pailis.
1888-89	...	...	317	13	4 $\frac{1}{2}$
1889-90	...	...	148	7	5 $\frac{1}{8}$
1890-91	...	...	234	8	0 $\frac{1}{8}$
1891-92	...	...	260	11	8 $\frac{3}{4}$
1892-93	...	...	304	11	4 $\frac{3}{4}$
Average 5 yrs.			253	2	4 $\frac{3}{4}$
1893-94	...	...	549	9	6 $\frac{3}{4}$

I notice that this year the climatic symptoms are very similar to those of last year, and that the absence of hail-storms has, in addition to what I formerly mentioned, been a very probable cause of the abnormal increase, or at any rate one of the concomitant factors.

R. S. FAGAN.

“Block in promotion.”

SIR,

As you have inserted a letter from a Bombay Forest officer on the above subject, it is but fair to bring to notice the very great block in the Punjab, C. P. and Berar list which is much worse than in Bombay or anywhere else. Officers of 23 and 24 years' service are still 3rd grade Deputy Conservators, and the block is proportionately bad in the lower grade. So when a chance of promotion does occur, it is particularly galling not to be given it. Mr. R. Thompson, Conservator, who reached the age of 55 in December, 1893, obtained one year's extension, and now it is believed he is to be allowed to serve on for another year, and perhaps a third!!

During 34 years' service Mr. Thompson has never given his juniors a chance of acting promotion—having never taken furlough—not even privilege leave, except on one occasion: therefore nothing is due to him from Government on the score of half-pay!

Surely there cannot be any reasonable ground for granting this officer a second year's extension when it is remembered that Col. Doveton, who ought to be considered the father of the C.-P. Forest Department and who *slaved* at his work all his service, failed to obtain even *one* year's extension though he tried hard to get it. Any way, he gave us some 6 years' acting steps by taking both long and short leave.

A. J. C.

30th July, 1894.

334 BUDGET ESTIMATES OF THE FOREST DEPARTMENT FOR 1894-95.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Budget Estimates of the Forest Department for 1894-95.

The Budget Estimates for 1893-94 were on page 380 of our last Volume. The following are the figures for 1894-95.—

PROVINCES.	1892-93.				1893-94.				1894-95.			
	ACTUALS.				REVISED ESTIMATES.				FINALLY SANCTIONED BY GOVERNMENT OF INDIA.			
	Receipts.	Charges.	Surplus.		Receipts.	Charges.	Surplus.		Receipts.	Charges.	Surplus.	
	Rs.	Rs.	Rs.		Rs.	Rs.	Rs.		Rs.	Rs.	Rs.	
INDIA.												
General Direction	..	77,432	-77,432		..	76,000	-76,000		..	73,000	-73,000	
Imperial Forest School	5,287	1,375	3,912		4,000	2,000	2,000		4,000	2,000	2,000	
Survey	1,083	50,304	-49,221		2,000	66,000	-64,000		3,000	65,000	-62,000	
Almora	14,887	22,137	7,250		28,000	28,000	—		..	30,000	-30,000	
Andamans	8,004,486	14,907	14,907		14,000	15,000	-1,000		..	15,000	-15,000	
Baluchistan	13,037	2,31,206	-2,18,169		4,54,000	2,54,000	2,00,000		4,00,000	2,17,000	1,83,000	
Coorg	1,80,676	55,682	1,24,994		23,000	28,000	-5,000		30,000	67,000	-37,000	
TOTAL INDIA	5,82,825	5,26,169	56,656		1,52,000	87,000	65,000		1,47,000	88,000	59,000	
Central Provinces	12,30,855	8,50,940	3,79,915		6,49,000	5,96,000	53,000		5,99,000	5,57,000	42,000	
Upper Burma	20,76,629	4,40,929	16,35,700		12,10,000	9,40,000	2,70,000		14,00,000	10,50,000	3,50,000	
Lower Burma	36,83,372	13,61,838	23,21,534		38,00,000	5,00,000	33,00,000		30,25,000	6,25,000	24,00,000	
Assam	8,82,829	2,63,904	6,18,925		34,00,000	13,95,000	20,05,000		32,00,000	13,85,000	18,15,000	
Bengal	7,44,882	3,81,262	3,63,620		4,34,000	2,74,000	1,60,000		4,30,000	2,96,000	1,34,000	
North-Western Provinces and Oudh.	16,52,539	9,22,397	7,30,142		7,32,000	4,11,000	3,21,000		8,00,000	4,60,000	3,40,000	
Punjab	8,12,632	6,55,118	1,57,514		8,50,000	6,50,000	2,00,000		9,00,000	7,00,000	2,00,000	
Madras	15,77,212	13,22,888	2,54,324		19,00,000	13,44,000	5,56,000		18,00,000	15,45,000	2,55,000	
Bombay	82,69,544	18,98,269	63,71,275		35,50,000	21,00,000	14,50,000		36,00,000	22,47,000	13,53,000	
TOTAL	1,53,30,494	80,97,625	72,32,869		1,61,22,000	85,94,000	75,28,000		1,58,61,000	92,75,000	65,85,000	
England	..	17,770	-17,770		..	12,000	-12,000		..	7,000	-7,000	
Exchange on charges in England	..	10,690	-10,690		..	8,000	-8,000		..	5,000	-5,000	
GRAND TOTAL	1,59,13,319	86,52,254	72,61,065		1,67,71,000	92,10,000	75,61,000		1,64,60,000	98,44,000	66,16,000	
Berar	4,31,017	2,20,230	2,10,787		4,90,000	2,62,000	2,28,000		5,00,000	2,50,000	2,50,000	

Statistics of Trade in Forest Produce in 1892-93.

Total weights and values of articles carried by Rail and River in British India during the year 1892-93, i.e., between 1st April, 1892, and 31st March, 1893.

ARTICLES AND WHENCE EXPORTED.	IMPORTED INTO.			VALUE.			
	British Provinces, excluding Chief Seaport Towns.	Native States.	Chief Seaport Towns.	Grand Total.	British Provinces, excluding Chief Seaport Towns.	Native States.	Chief Seaport Towns.
	Mds.	Mds.	Mds.	Mds.	Rs.	Rs.	Rs.
MYRABOLANS							
British Provinces (excluding chief Seaport Towns)	16,356	15,071	5,80,846	6,12,273	50,286	56,516	15,91,778
Native States	51,320	..	41,048	92,368	1,58,054	..	1,48,010
Chief Seaport Towns	10,935	4,455	26	15,416	43,546	16,066	59,696
Grand Total	78,611	19,526	6,21,920	7,30,057	2,52,426	72,582	17,39,872
OUTCH							
British Provinces (excluding chief Seaport Towns)	17,610	4,081	10,280	31,980	2,74,478	60,906	4,92,749
Native States	2,584	..	656	3,240	41,579	..	50,640
Chief Seaport Towns	13,688	1,126	..	14,814	2,28,180	16,967	2,46,147
Grand Total	33,882	5,207	10,945	50,034	5,45,237	77,873	7,89,536
HORNS							
British Provinces (excluding chief Seaport Towns)	9,786	138	47,612	57,531	63,292	1,354	7,29,589
Native States	2,419	..	9,948	12,368	35,778	..	1,52,939
Chief Seaport Towns	4,067	68	25	4,164	73,846	1,008	74,764
Grand Total	16,272	196	57,586	74,053	1,72,416	2,362	10,57,746
LAC (1) STRICK.							
British Provinces (excluding chief Seaport Towns)	1,94,800	2,466	47,512	1,94,808	23,38,126	46,094	31,03,733
Native States	7,310	..	31	7,341	1,19,014	..	1,19,636
Chief Seaport Towns	9,769	85	2	9,796	2,06,178	1,691	2,07,916
Grand Total	1,51,849	2,551	47,545	2,01,945	26,63,318	48,785	34,91,285
LAC (2) SAWN.							
British Provinces (excluding chief Seaport Towns)	1,820	549	1,25,896	1,28,265	64,523	18,486	47,38,978
Native States	380	..	22	402	11,761	..	12,458
Chief Seaport Towns	699	51	..	750	26,619	1,796	28,414
Grand Total	2,899	600	1,25,918	1,29,417	1,02,903	20,281	46,56,685
Total Lac.	1,54,748	3,151	1,78,463	3,31,362	27,66,221	67,036	53,77,897
							32,11,164

Forest Policy in Bombay.

The following unofficial Note, by the Inspector-General of Forests, on some questions of forest policy now under consideration in the Bombay Presidency, will be read with great interest by most of our subscribers. It gives the personal views of Mr. B. Ribbentrop, C. I. E., on the subject, and we hope its views will commend themselves to the Government, and end in securing a better Forest system for the Presidency than it has hitherto enjoyed.

The first question on which I beg to record my opinion is that connected with the division of lands at the disposal of Government into forests proper, fuel and fodder reserves, and pastures.

It is evident to me from a study of the Bombay Government's Resolution No. 6840, dated 5th October, 1891, that the Government of India's Circular No. 17—105 of 15th July, 1891, has, in some particulars, been misunderstood. So far as I am aware, the Supreme Government did not contemplate, when issuing that Circular, that the existing forest reserves should necessarily be sub-divided into forests, fodder and fuel reserves, and pastures; and though it was doubtless recognised that certain portions of these reserves might be treated with the primary object of producing fodder or even as pasture-lands, it was by no means considered essential that their connection with the Forest Administration should be severed.

It seems clear that the Circular had in view an analysis of each district as regards the supply of fodder and the demands made on that supply, and that in this analysis the supplies available from forest reserves should find their due place. For, even under the most conservative forest treatment, there must always be considerable areas which yield fodder and perhaps pasture; and a rational management of fodder-reserves, and even of pasture-lands, does not entirely exclude a certain amount of tree-growth.

This view apparently coincides with that expressed by the Honourable Mr Trevor in his minute of 16th January, 1893, and has since been supported by the Government of India in paragraph 8 of letter No. 217-F., dated 20th February last.

The remarks which follow refer, in the first instance, to the Deccan, which from its circumstances has been persistently cited as peculiarly unsuited to a conservative forest management necessitating any interference with the customs and habits of the people. Owing to the short time at my disposal while on tour, I could not undertake anything but a very superficial examination of the Deccan forests; but I purposely selected for inspection and enquiry areas within easy reach of the railway lines, which were said to be the least adapted for conservative management. I am therefore disposed to believe that my views refer

with equal force to other areas similarly situated, and still more so to forests of which the conditions are less unfavourable.

I am fully convinced that the whole of the Deccan was once forest clad. My reasons for this opinion are the existence of solitary trees, even in the most exposed localities, and the improvement which has taken place in the forest-growth where hillsides have been closed against grazing, as in the driest parts of the Poona and Sholapur districts, for example. The soil in localities so protected for some years is entirely different in its physical characteristics from that in the areas open to grazing. The grass-crop has not merely improved in quantity but most decidedly so in quality and denseness, and tree-growth has established itself to a considerable degree, even in places where no artificial means have been used to assist nature in this respect. The tree-growth is as yet represented only by bushes, which is but natural, as in many instances the very soil had been washed away previous to the introduction of conservative management and closure which, to judge from the browsed state of much of the brushwood, has hardly ever been entirely successful. In spite, however, of these disadvantages, I have no doubt that many of the bushes will grow into trees, and that the wood-crop of the next generation will show a great improvement in growth as well as in variety of species.

It cannot, I think, be gainsaid that, from a strictly climatic, physical and economic point of view, it would be of incalculable advantage if a considerable portion of the Deccan uplands, including at least all tracts of which the slope is 15 degrees and upwards, were again brought under tree-forest, instead of being occupied, as is the case at present, by fields, open pastures or scrub jungle.

A reforestation of the kind would not be physically impossible, but as it would necessitate a much stricter closing of the present grazing-areas, and closing for such a length of time, it would be incompatible with the existing economic and political conditions of the country, and this alone would prevent its ever being carried into effect.

While, however, I fully recognise the impossibility of ever restoring the economically correct balance of forest and open lands in the Deccan, I cannot but consider it the duty of Government to treat those areas which are still at its disposal as conservatively as circumstances will permit.

If no other considerations came into play than the ultimate good of the country, it would be advisable to close for an indefinite time, not merely to grazing but to grass-cutting as well, all reserves situated on hilly ground; but the fact has to be faced that the lands in question must now, and probably for ever,

yield a considerable portion of the fodder-supply of the country, especially as there is no prospect whatever of grazing-areas beyond the limits of State reserves being subjected to an intelligent and conservative treatment.

It must also be recognized that areas primarily treated for the growth of trees yield less fodder than forests treated for the production of fodder or pasture, in which the growth of trees or bushes is a secondary consideration. I maintain, however, and venture to challenge proof to the contrary, that the system which more than any other, results in the continuous diminution and degradation in the character of the fodder-supply, is the system at present in vogue outside our forest limits, and to a considerable extent within them, *viz.*, the non-restriction of grazing as regards number of cattle admitted, and even more so as regards the season of admission. This seems to be the strongest objection to the argument (which occupies so prominent a place in Sir Charles Pritchard's minute) that free-grazing should be allowed in order to maintain the supply of cattle.

Whilst I thus agree, as regards the Deccan, in the necessity of separating the State forests into fuel and fodder reserves and pastures, according to the management which it is proposed to apply to each category, I maintain that each class must be treated so as to yield the maximum of natural produce in quantity and quality combined, be the produce timber, fuel or fodder.

That this can only be effected under an intelligent and reasonable treatment is an accepted axiom in more civilised countries and has been happily illustrated of late by the successful management of the military grass farms in the north of India.

It is evident that a rational treatment of the kind cannot be carried into effect without serious restrictions, and amongst them a limitation of grazing, both with regard to the number of cattle admitted and the season during which grazing takes place. There can be no doubt that in this country such restrictions necessitate a considerable interference with the customs and habits of the people.

The difficulties in this respect are connected, in my opinion, not so much with the original reservations, which frequently were (see Sir Charles Pritchard's minute) easily made when the forests taken up in no wise differed from the surrounding country, but rather lie in the fact that, as soon as some years of protection have produced magnificent grass crops, which stand out like oases amidst the barren grazing-grounds, a popular clamour arises, and with it the difficulties of the administration.

The change in the conditions is not, I venture to think, due to the transfer of the management of the forests from the Revenue to the Forest Department, but to the gradual development of a

more rational management under which the grazing area is doubtless curtailed, but by means of which the fodder supply available, even from the restricted areas, has certainly been increased. I question whether, under such conditions, it would be advisable or even equitable to the people to remove any of the restrictions necessary to produce the maximum quantity of grass. I believe that it would be in every respect advantageous if the control rested as heretofore with the Forest Department.

The restrictions required to ensure a rational management have no connection with the consideration of free-grazing privileges from the monetary aspect. This is a question of financial and not of forest policy, and the Forest Department is only indirectly interested in it. Experience, however, teaches that the privilege of free-grazing has usually had a demoralizing instead of an encouraging effect on agriculture, and has frequently led to the up-keep of many useless cattle. The advisability of encouraging, in a more or less settled agricultural country, semi-nomadic professional graziers seems also open to question. As a rule, such graziers disappear with the advance of agriculture.

I have above acknowledged the advisability of a departmental separation of the areas under the control of the Department in accordance with the purpose which they should serve in the first instance. In my opinion, each reserve should be studied separately, and the decision should, in each case, be based on the following considerations :—

- (a) physical (including climatic) ;
- (b) economic and agricultural ;
- (c) financial ;
- (d) political.

The first (a) need be taken account of only when the area in question is of considerable extent, or occupies slopes the denudation of which would endanger lands lying below, or affect works of public utility, such as roads, railways or tanks. In such cases these considerations may be of great importance, and an area selected for these reasons should be thoroughly protected, as little or no physical effect can be expected to be derived from an open scrub jungle. The area would therefore naturally be classed as forest.

I have seen during my short tour several forests which I would unreservedly place for the above reasons in the category of forest proper, though I would recommend in such cases a treatment varying in strictness. A gradual and periodical closing would be advisable of the areas more favourably situated for the production of tree-growth. I would close others entirely, not merely to grazing, but against grass-cutting as well, and for an

indefinite period. As an example of a case where a radical course of the kind would be desirable, I may cite the forest block south of the Phursangi railway station, on the Southern Mahratta railway and to the west of the line, but there are, I daresay, many other blocks of equal importance. The reserve in question occupies a steep slope which overhangs the railway for a considerable distance, and the drainage of which flows into the Nira valley. A more unpromising area could hardly be found, but for this very reason its strictest protection is the more necessary. To insure the success of fire protection, a trace should be burned above the railway line; and in order to make closure against grazing more effectual, the most exposed boundaries should, I think, be fenced with barbed wire. I am of opinion that it would be of advantage if every Deccan forest division were furnished with 5 to 10 miles of barbed wire-fencing, to assist in the protection of areas closed entirely or periodically against cattle trespass, the prevention of which throws at present a great strain and much undeserved *odium* on the Forest Department.

Considerations mentioned under (b) would, in most instances, show whether an area should be classed as a fuel and fodder reserve or as pasture land. Thus, small scattered blocks of less than half a square mile in extent, for instance, cannot possibly be of any special value as pasture-grounds, but may be of great importance as fodder-reserves, especially if favourably situated. The economic value of timber and fuel in a district particularly in want of these commodities may also often decide whether an area is to be primarily maintained for the supply of such produce. For instance, an affirmative decision of the kind seems decidedly advisable as regards the valuable babul reserves on the Bhema and other rivers.

The reason given under (c) may frequently decide the question as regards areas where other conditions are more or less equally balanced, as in the case of small babul forests which though of no importance for climatic reason, may bring in a considerable revenue per acre. Considerations of the same kind might show that some of the very small isolated reserves should be entirely abandoned, in cases where expenditure on protection and treatment is equal to or exceeds the revenue, and where none of the other reasons demand the maintenance of such small forests.

Political reasons (d) may in some cases outweigh all others in favour of some particular treatment and classification; but, in my opinion, undue weight should not be given to the existence of old habits and customs, which frequently change rapidly under the pressure of circumstances.

If an area has been classed as forest proper, the aim should be to establish a complete leaf-canopy as soon as possible. In extreme cases all grazing should be excluded, and the whole or at

least a considerable portion of the forest should be closed even to grass-cutting. Under any circumstances, grazing and grass-cutting should be so regulated that at least one-fourth to one-third of the area should be closed for a period of years, which should certainly not be less than ten.

As a rough sketch for a plan of working the Deccan hill reserves, such as those which I have seen during my recent tour, I venture to submit the following proposals for consideration : that one-third of each block be closed both to grazing and grass-cutting ; that this closed area be divided into ten compartments ; that at the end of ten years one compartment should be thrown open (but not during the rains) to grazing or grass-cutting, as the case may be : and that closed compartments of about the same area be added from the unclosed block, and so on. Thus forty years will have elapsed from the first closure until the compartment first opened is closed again, and by that time it will probably be possible to accompany the second closure by a slight improvement-felling.

When an area has been classed as a fuel and fodder reserve, it should be closed against regular grazing, though even under a good system of management it may be thrown open to grazing from time to time, especially in years of scarcity after the grass crop has been reaped. To throw it open annually to cattle would tend to exhaust it ; for when fodder is reaped the grass is never very closely cut, and a considerable portion of what is left serves as manure for the next year's crop. Moreover, the cattle, if admitted annually, would attack the edible bushes, and the aim that the area should furnish a reserve of fodder in years of scarcity would be defeated.

Grass-cutting in fuel and fodder reserves should be carried on with caution and under strict rules, so as to ensure the safety of ligneous growth. In this connection, I may mention that during my visit to the Brambuede reserved forests, I observed that the Commissariat contractor had used a mowing machine, the course of which was marked by stumps of young trees and plants, and that in other places, also unsuited to the use of the machine, the tree-growth had been treated in a ruthless manner. This is highly objectionable ; and though it may be advisable to place forest resources at the disposal of the Military Department, without showing the true financial aspect of the question, such a careless and destructive gathering of produce should not, I venture to think, be permitted.

As regards the treatment of pastures, I have already recorded my opinion that the aim should be to grow annually as much and as good fodder as possible, and in order to effect this it is indispensable that both the number of cattle admitted and the season of grazing should be limited. This may not be

the popular course to take, but it is common sense ; and the system by which the largest amount of fodder can be produced should, as a rule, be adopted in spite of popular opposition. The question is one which increases in importance in proportion as the country is dependent on these sources of supply.

If it be granted that such restrictions, even as regards areas classed as pasture, are necessary, an establishment must be maintained which is fit and able to enforce them ; and since the District Forest Officer is directly subordinate to the Collector, I venture to doubt whether the latter officer has a better, more efficient, or cheaper agency than the Forest Department at his disposal.

In this connection the fact should not be lost sight of that, under any circumstances, a considerable portion of the existing reserves must be classed as forests proper ; the areas must be territorially intermixed ; and that the treatment to be applied to all, though varying in detail, is similar in its general character.

I am convinced that a separation of the charges would certainly result in an increased expenditure. I cannot close this paragraph without pointing out that, though it has been laid down that the system for the treatment of pasture-lands shall be such as to exclude, as far as possible, interference on the part of subordinate officers, this refers to the closure and opening of grazing areas, and not to the necessary protection of areas authoritatively closed and the impounding of trespassing cattle, especially where trespass takes place systematically.

I am personally opposed to the award of a double punishment under the same law. Trespassing cattle are first impounded and the evidence of the pound certificate is used to bring an action for trespass, or in order to compound the case. It has, however, been pointed out to me that the opinion of the Magistrates and the rulings in force are in favour of this procedure. I should have thought it more advisable to increase authoritatively the pound fees, or to withdraw the privilege of grazing agricultural cattle at reduced rates from any habitually offending village, or even to increase for such a village the general grazing fees.

As regards the executive and subordinate forest establishments, I have already pointed out that I consider the withdrawal of a portion of the Deccan establishment impracticable and inadvisable. No doubt forest establishments find a proper place in real forests, but they are even more required in those parts of the country where it is considered advisable to establish forests. As far as I am able to judge, the ranger class especially is insufficiently represented in the Bombay forest staff, and good rangers cannot be obtained in a day. Lastly, I cannot possibly agree with the view expressed that ranges should be formed in accordance with the magnitude of the timber revenue.

Apart from the questions regarding the position of Conservators towards the Government, and the rules referring to the relation of Revenue and Forest Officers, which, if my opinion thereon is desired, will be treated of in a separate note, I have only two more points to remark upon.

The first refers to the advisability of having the whole of the coupes, into which the forests are divided for purposes of working, and which as yet exist only on the maps, laid down and demarcated on the ground. Till this is done and the maps have been corrected accordingly, the plans, though doubtless they have done much to systematize work, must bear the stigma of being paper plans only. There is no guarantee that the coupe of one year will yield a tenth or even a twentieth of that of the previous year, though it can unquestionably be urged that, with a large number of working-circles, variations in the outturn will equalize themselves. Nevertheless, the demarcation on the ground should, if practicable, be effected as soon as possible; for in the meanwhile a permanent working-plans officer will be required for no other purpose than to transfer the position of the annual coupes from the maps to the ground.

In conclusion, I venture to suggest the establishment of one or more teak forests below the ghats, to be treated for the growth of large timber. For this purpose areas of not less than 5,000 acres in extent should be selected and set apart from the existing forests. They should be carefully fire-protected, and closed against grazing and grass-cutting of every description, and should from the outset be treated with the view of establishing high timber forests of teak. If the areas are carefully selected as regards soil, position and parent trees, I doubt whether it will be necessary to have recourse to artificial cultivation on a large scale, though it will of course be advisable to assist natural reproduction by clearing away brushwood, lightly breaking up the soil, and by dibbling in seed in prepared patches, or even to certain extent by planting.

It may also be advisable to procure every year, from Burma or Canara, teak seed from full-grown and healthy seed-bearers; but on the whole I think we may trust to natural reproduction, for it is a historical fact that some of the Malabar forests at one time contained the finest teak in the world.

CAMP,

B. RIBBENTROP,

11th March, 1893.

Inspector-General of Forests.

IV.—REVIEWS.

A Bombay Forest Flora.

Under the modest title of a "Systematic List of the trees, shrubs and woody climbers of the Bombay Presidency" has just appeared what practically is a Forest Flora of Bombay. In the small compass of 230 octavo pages, the author, Mr. W. A. Talbot, Deputy Conservator of Forests, has published a work which fills a most important gap in our knowledge of the forest vegetation of India. It is by no means only a *List* that Mr. Talbot has prepared. It is what, to our mind, is wanted in all Provinces, a concise account of the trees and shrubs with the simplest possible means of identifying them, brought up to date with the assistance of the "Flora of British India," by Sir J. D. Hooker, now approaching completion; and its preparation is a credit to its author, and through him to the Forest Department in India, which has sometimes been twitted with its apathy as regards botanical knowledge of the vegetation it has to deal with. As a model Forest Flora, no work, not even that of Willkomm for Germany, can, in our opinion, touch the "Flore Forestière" of our late honoured Nancy Professor, Mr. Auguste Mathieu; but very near it indeed will come the 'Forest Flora of North-West and Central India,' by Sir D. Brandis, which still holds its own as the guide of all the forest officers whose lot it is to serve in the Punjab, the North-Western Provinces and the Central Provinces with the adjoining Native States. For Lower Burma we have the admirable, if lightly too technical, flora of the late Mr. Sulpiz Kurz; and for the Madras Presidency there is the "Flora Sylvatica" of Col. R. H. Beddome, which is unfortunately too much spoilt by its unwieldy size and by the inclusion of Ceylon plants, which make it very difficult to consult. Hitherto, Bombay officers have had to be content with Dalziel and Gibson's "Bombay Flora," but that work, excellent as it was for the time it appeared, is now out of date, and we are sure that they will all welcome this new work, and make it the standard authority of their Presidency. The only great area now remaining to be done is that of North-East India in Bengal and Assam, but that will be by no means an easy task.

Mr. Talbot has done quite rightly in reducing his work to a manageable size, those who want further botanical details can always go to the Flora of British India, but for ordinary purposes Mr. Talbot's work should amply suffice.

The Bombay Presidency, says the author in his Preface, contains, as principal regions, (1) Sind, (2) the Deccan with Khandesh and, we presume, Guzerat, (3) the Konkan and (4) North Kanara. The first and second are dry regions, the others moist ones, the last being "a very important great region of three thousand square miles of more or less continuous jungle," which probably furnishes the larger part of the species described.

The book gives, first of all, a key to the natural orders, then the descriptions of the plants under their orders. Each order is briefly described, then follows an analysis of the genera, then the descriptions of the genera, then an analysis of the species themselves, with the references to previous authors, the native names and the geographical description. Here and there, as especially under *Rubiaceæ*, some new species are described. The only fault we can find is that the analyses are difficult to follow. Instead of printing the selected points in gradually indented lines, they are all given in one vertical line, and it is by no means easy always to trace the alternative characters. Should a new edition be called for we hope that this may be rectified. Here and there we notice small printer's errors, such as are inseparable from work done in this country, and the binding might be better, but on the whole the work is creditable to the Bombay Government Press. We cordially congratulate Mr. Talbot on his work, and feel sure that all those whose duties take them into the Bombay forests, will thank him for his excellent manual of their vegetation.

Annual Forest Administration Reports for 1892-93 for Assam, the North-West Provinces & Oudh and the Forest Surveys.

The ASSAM report shows that a great deal of steady work was done during the year in almost all the branches of Conservancy and Works. The financial results were very favourable, the figures for the first year of 15 months on this occasion having been:—

Receipts	...	...	4,76,620
Expenditure	...	...	3,36,060
Surplus	...	...	1,40,560

Naturally enough, the Chapter on reproduction is the one of most interest to us and our readers. In it we find the question of the gradual spread of Sal forest over the areas of grass land known as Savannahs discussed, and it is satisfactory to note that Mr. Campbell, the Goalpara Divisional officer, considers that *Sál* is gradually replacing secondary growth of an inferior description. On the flowering of this during the year he says:—

"In the year under report, flowering was not only partial but almost non-existent, and no fruit resulted from the few flowering specimens. This was the result of intense cold and rain at the period of most active vital growth, not admitting of assimilation. The tendency of extension is easterly, as seeding usually occurs during the prevalence of violent south-westerly breezes. Khoir (*Acacia Catechu*) and Sisu (*Dalbergia Sissoo*), favouring shallow soil, are also spreading rapidly, the former possessing the great advantage of persisting during floods. With its weak ramification and want of tap-roots, however, it succumbs to storms. It exists in greater or less quantities throughout the district, and is extending. Of Sisu there is much pure forest, as well as that mixed with Khoir. Both are disseminated by water and establish themselves and spread by ordinary methods, suckers being a huge factor in Sisu. There is a great future in store for this forest.

"Other valuable marketable timbers also exist and are extending, such as the various Myrabolams (*Terminalia Chebula* and *Belericæ*) and Simul (*Bombax malabaricum*). The latter, like the Sal, was conspicuous by absence of inflorescence during this season, except in the western corner of the district."

The Conservator also mentions that in Sibsagar District, the natural reproduction of Nahor (*Mesua ferrea*), Ajhar (*Lagerströmia Reginæ*) and Sam (*Artocarpus Chaplasha*) was very good; while that of Holong (*Dipterocarpus pilosus*) and Hollock (*Terminalia myriocarpa*) was a failure.

The question of whether old over-mature Sal trees can be relied upon to produce good seed, was tested, as described in the following extract, in the Garo Hills :—

"With a view to ascertain whether the over-mature Sâl trees in the Dambu reserve do still retain the power of reproduction or not, the Divisional Officer, under the suggestion of the Conservator, selected a dozen over-mature trees in that forest, from which seeds were collected carefully and sown separately on prepared beds, one seed bed being appropriated to seeds from each tree. Manure in the shape of wood ash was freely supplied to these beds at the time of their preparation. The trees from which the seeds were collected were numbered and labelled, and a corresponding number was put on each seed bed. The seeds were sown in June, 1892, and after a few days they germinated freely. It was thought, however, that the seedlings would not survive; but, contrary to expectation, they are still living and growing with vigour.

"The germinating power of Sâl seed is so extraordinary that, even under Kakuabamboos (*D. Hamiltonii*) in many places, seedlings are noticed to grow. The absence of Sâl seedlings in the younger forests is due to the density of the crop. In the plains forests, such as Chima, Bangshi, Dhima, Dilma, &c., the reproduction of Sâl is more satisfactory."

The well-known plantations of India-rubber at Charduar were the subject of much correspondence during the year, with the result, we understand, that the Government of India have stopped further expenditure for a time. The plantations now cover 2,063 acres, and contain 28,546 good trees.

We are glad to see that both the Local Government and the Government of India speak in high terms of Mr. McKee's administration and of his excellent report.

The chief noticeable point about the volume referring to the NORTH-WESTERN PROVINCES AND OUDH is the rather effusive Review by the Government of India, who say :—

“The conservancy and management of the valuable forests of the North-Western Provinces and Oudh have, it is evident from the reports under review, been characterized by energy and ability, and the local administration may fairly claim to have secured a leading place among the provincial Forest Departments.”

They give especial credit to Mr. Wilmot, the Oudh Conservator, and remark that the progress made in late years has been—“largely attributable to the interest displayed by the Local Government in the settlement of forest questions, but also in some part to the equipment of the province with capable forest officers, whose aim it has been to place the permanent constitution and current management of the forests on a safe basis, and to secure an effective demand for forest-produce proportionate to the general development of the country. Mr. Wilmot's excellent work in Oudh affords an illustration of the valuable results which can in a few years be obtained by intelligent organization in this direction.”

Of the three Circle Reports we have found that of the Central Circle the most interesting as regards matters suitable for notice on our part. There are some interesting statistics given in an Appendix, obtained from the results of measurements of Sâl trees taken in sample plots. The Conservator, Mr. Hill, considers that the average increase in girth is better arrived at by calculating from the original measurements made in the first year of observation and those of the last, than by taking the average of ascertained annual increments, but gives the results obtained in either way. We give the results taken from the sample areas which have been longest established, that is, for 9 years:—

	KUMAUN DIVISION.				GARHWAL DIVISION.	
	Lachman Mundi.		Sunman Thapla.		Amtanola.	
	Thinned.	Unthinned.	Thinned.	Unthinned.	Thinned.	Unthinned.
(1)	·80	·35	·65	·34	·79	·38
(2)	·77	·30	·63	·37	·65	·33

where (1) is the average annual increase in girth per tree, from yearly increase; and (2) is the average annual increase in girth per tree, from 1st and last years.

Mr. Hill concludes from the measurements that 3rd class trees of 3 ft. in girth will attain $4\frac{1}{2}$ ft. in from 26 to 37 years, and that 4th class trees of $1\frac{1}{2}$ ft. will become 3rd class in from 16 to 23 years under favourable conditions.

In remarking on natural reproduction, there are some interesting points noted about that of oak and 'chir' pine, which we quote:—

"Regarding the hill forests the Deputy Conservator of the Naini Tal Division reports as follows :—

"It has been a good seed year for oak. The Conservator considers that the young growth of chir in many parts (especially of the Ránikhet Sub-Division) upon which we were priding ourselves, is really stunted and unpromising, and the bulk of it has scarcely made way for many years, though possibly some has with difficulty now escaped from the damage done to it in early times. Oak, Rhododendron, Ayar (*Pieris*) and Kaiphal (*Myrica sapida*) are spreading well in among the chir, where they will eventually doubtless fill up the spaces which are practically always to be found in chir forest, and at the same time will, in addition to thus increasing the amount of material per acre, render the ground cooler and make fire conservancy much easier."

"The open and most incomplete condition of many of these forests can scarcely be held to bear out the satisfactory remarks on natural reproduction which have appeared in the progress reports of past years, and the opinion is hazarded that the officers reporting have fully understood the absence of that power in the young *Pinus longifolia*, which failing is common to all light-loving species, to recover and gain vigorous health after undergoing years of suppression or injury. This want of appreciation of the silvicultural requirements of the chir has in places led to heavy fellings over an advance growth which has but little promise, and where it might have been better to have rooted up the existing young growth and waited for the establishment of a new crop. The broad leaved species are spreading without doubt, but it seems evident that the regeneration and complete stocking of the closed areas would be very much expedited by the removal of the stunted young chir, and by the dibbling in of acorns on a large scale. The oaks seed with regularity, and the cost of dibbling is a little more than a rupee an acre. *Pinus longifolia* seeds more rarely, and advantage might be taken of good seed years to prepare the soil in patches in blank places. With so much aid

'given to natural reproduction, these forests might be gradually converted from the open grass-growing lands, which too many of the compartments now are, into dense mixed forests of chir and oak.'

The remarks of the Oudh Conservator show that there has been much confusion in settlement work in former years, for he says :—

"Much labour and research was expended during the year in overhauling the notifications regarding the constitution of the State Forests. There were instances of areas proposed for reservation, but never finally reserved ; of areas exchanged, but not disforested ; of areas belonging to State Forests, but neither claimed nor reserved. A series of reprints of all necessary notifications from 1865 up to date was issued from the Head Office to each Division, and it is hoped that now order is in some measure restored, there will be little difficulty in maintaining it." And we believe that similar rectifications are going on in the other Circles as well.

In regard to artificial reproduction, Mr. Wilmot has some rather strong remarks which deserve to be read. We agree with him that spending money on planting works without very careful consideration of the suitableness of the locality, of the kinds to be planted, and the object of the work is much to be deprecated ; but at the same time we believe strongly that the improvement of the natural forests, if well done, requires considerable assistance from artificial work, and in suitable places the establishment of well stocked plantations is a very important means of increasing and improving the forest area. We need only point to Changa-Manga as an example of the latter kind, and to the successful filling of blanks in the Jaunsar and other deodar forest, in the North-West and Punjab Himalaya as an example of the former. Such works are very valuable, but the planting of Sissu in water-logged lands such as those of Gorakhpur or those of Pathri in Saharanpur is a waste of money and energy, as is the endeavour to make species of Eucalyptus grow in places where they cannot give products at all as good as what are furnished by the indigenous timber trees. Mr. Wilmot says :—

"No cultural operations were carried out in the circle during the year ; existing plantations were kept up, but available funds are more profitably employed in opening up natural forests than in futile gardening in unsuitable localities. The principal plantations of the circle are situated in Gorakhpur, the largest area being 2,206 acres under Shisham at Sakwi. The Divisional Officer anticipates that here, as elsewhere, where grown on a water-logged soil, the Shisham may die off, before reaching maturity, so soon as the main roots reach water level. The other petty plantations are interesting, but the time spent on them

'would have been more profitably employed in protecting and improving the important forests of the circle, for where natural reproduction of valuable species is forthcoming, the artificial rearing of exotics should be regarded only as a pastime.'

The financial results for the forest year, July 1st, 1892, to June 30th, 1893, for which the Reports are submitted were :—

Receipts,	17,46,269	} The <i>net</i> revenue being 45 per cent. of the <i>gross</i> .
Expenditure,	9,53,411	
Surplus	7,92,858	

The Report of the Superintendent of the Forest Surveys shows the usual progress in field Survey, tempered by the inability of the Imperial Survey to keep pace with it in the publication of its maps. The area surveyed during the year was 1,804 square miles, of which 851 square miles were demarcated State Forests. Most of this area was mapped on the 4-inch scale. Work was in progress chiefly in Bashahr, in the Punjab, in Pilibhit and Kheri in Oudh in Raipur, Narsingpur, Bhandara and Mundla in the Central Provinces ; in Goalpara in Assam ; in the Tenasserim Circle of Lower Burma and in the Pyinmana District of Upper Burma.

The cost of the work naturally varied in different Districts, but we extract the following rates per square mile :—

	4-inch Scale	1 inch Scale
	Rs. 59	Rs. 10-5
Bashahr	Rs. 59	
Raipur	„ 48·5	
Bhandara	„ 53·9	
Mandla	„ 50·6	
Narsingpur	„ 57·9	
Oudh	„ 18·0	
Goalpara	„ 89·9	
Tenasserim	„ 81·7	
Pyinmana	„ 36·3	

The total expenditure of the Department was Rs. 1,25,513.

The exceptionally heavy cost of the Assam work is explained by the difficulty of the country worked in, which is well shown by the following extract from Mr. E. Litchfield's Report :—

“ The survey of the Goalpara forests has been a most difficult and troublesome undertaking. The absence of labour and supplies on the spot, the want of roads, the difficulty of transport, the dark densely-growing forests with thickly matted undergrowth, the impenetrable grass 15 to 25 feet high, the opaque haze during dry months, the excessive rain beginning at the end of March when the whole country is flooded, the unhealthy malarial nature of the country, and the distance of the trigonometrical stations on

'the Brahmaputra on which the Forest survey is based from the
'Forest Survey stations on the Bhutan hills without any intervening
'hills or high ground suitable for connecting stations,—all combin-
'ed to add to the difficulty of surveying a naturally difficult,
'uninhabited and trackless area. On the Bhutan boundary the
'average rate of progress on the march was less than a mile an
'hour. Rice, ghee, dal, etc., were purchased at Dhubri, carried 50
'miles to Kochugaon, and stored there for distribution. Each camp
'was obliged to provide itself with a week's supply at a time, and
'in my own case I was obliged to carry, in addition, a supply of
'grain for the elephants. This did not leave much room for the
'very limited quantity of baggage and stores I carried for myself.
'But mutton, vegetables, milk and flour are not to be had ; and
'all ordinary stores must be imported from Calcutta."

Both the Surveyor General and the Government of India
comment in high terms of praise on the work done during the year
by the Superintendent, Mr. W. H. Reynolds.

Report on Forest Administration in the Jeypore State for 1893.

In the number for November last year, we reviewed the
Jeypore Report for 1892 and gave many extracts. The present
Report is fairly interesting also, but we regret not to be able to
trace the whole of the extracts said to be made from our Review of
last year.

The Superintendent gives an interesting account of the history
of the Madhopore forests, which appear to have been protected since
a very early date for the sake of the Fort of Ranthumbar, which
is situated inside them. In these forests, it is noted, that if bamboo
shoots do not get plentiful rain within a fortnight of their starting,
they are apt to die off.

The financial results of the year were :—

Revenue	...	...	...	25,342
Expenditure	...	...	...	8,405
Surplus	...	...	...	16,937

which is a little better than last year.

Report on the Botanical and Afforestation Department, Hongkong, for 1893.

As in previous years, a great deal of planting work has been done, the number of trees planted having been 279,648 or 232 acres. As usual, the chief tree planted was *Pinus sinensis*. The planted area ought now to be very extensive, but the Report gives no indication of the total.

During the year much damage was done by the caterpillars of a moth, *Eutricha punctata*, and considerable difficulty was found in destroying them, especially as they are of a kind with stinging hairs like the well known 'Kumbli' caterpillar, which feeds on babul trees in South India. No less than 30,219 trees were destroyed by this pest.

Fire-protection was as difficult as usual, and the damage done by fire was even greater than in 1892. This year, the fires are attributed more to grass-cutters, to people who remove dead pine leaves and collect cones, and to smokers, than to Chinese worshippers at their ancestors' shrines.

Report on Canal Plantations, N.-W. P., 1892-93.

Last year, in our December No., we remarked on the very unsatisfactory sort of report which is produced for these important works, and we are sorry to see that the one before us shows no improvement on its predecessor. With the exception of a slight reference to the Eucalyptus trees on the Upper Ganges canal, there is not a word about the species planted, or of the sylviculture of the plantations. And yet there must be interesting matters connected with them, which we Forest Officers would like to hear about. Though no mention of the fact is made in these arid reports, we believe that it is customary for the Conservator of Forests of the Central Circle in the North-Western Provinces to inspect them, or some of them, every year, and we would suggest that it would be interesting to add his Report as an Appendix in future.

The area of the plantations is given as 36,407 acres, which is 645 acres less than last year, but the decrease of a whole square mile of planted area is nowhere explained. We wonder what would be said if a Conservator of Forests reduced his planted area to such an extent without giving the reasons in his Annual Report!

The *net* revenue was Rs. 1,14,364, which is a little over Rs. 3 per acre. It is not stated, nor can we elicit from the very confusing statistical tables, how much, if any, of this is on account of establishment. Properly speaking a share of the pay of the Engineers who look after them should be debited to the work.

As regards the *Eucalyptus* about Kankhal it is now recommended that planting be stopped until it is ascertained that the wood is a really suitable one and cheaper than what is supplied from the forests, for the cribworks at the Hurdwar Anicut. We shall be very interested to hear the result, more especially as we have no belief in any of the *Eucalypti* being likely to do as substitutes for our excellent indigenous timbers.

Report on Arboriculture N.-W. P. & Oudh for 1892-93.

For the first time a separate Report on this subject has been published, and we have read it with interest.

From the return given in Appendix A we extract the following:—

	1st Class.	2nd Class.	3rd Class.	4th Class.	Total
Length of roads ...	4,674	7,016	10,073	4,790	26,553
„ of avenues ...	3,539	2,680	1,345	235	7,799
Balance without avenues	1,135	4,336	8,728	4,555	18,754

During the year 1892-93 185 miles were planted.

It is stated that in most districts the arboricultural works are managed by the Tahsildars.

The question of the best kind of 'tree-guard' is naturally discussed, the result being the recommendation of guards made of iron wire-netting which the Superintendent of the Saharunpore Botanic Gardens believes can be made at a cost of Rs. 1-2 each, 'provided he is allowed to purchase the netting from a particular firm in England.'

The Director of Agriculture recommends the greater use of the *Mahowa* (*Bassia latifolia*) as an avenue tree, also that the Babúl should be encouraged. No doubt Babúl will be useful for certain soils and in certain localities, but its drawback is that its crown is so low, and in South India, where it is common, it is infested with a moth whose small hairy caterpillar lets itself down by threads from the tree, and if it gets on to the skin causes a most painful itching. Perhaps this moth does not come up into Northern India, but we have seen the caterpillar and felt it, that is, one which we believe to be the same.

In respect to the objections held by native agriculturists to road-avenues, the Director says:—"In Allahabad, it is stated 'that private persons are showing increasing interest in the work; while from Jaunpur, on the other hand, the Chairman reports 'that the agricultural population have a rooted aversion to roadside avenues, on account of the damage done by shade to their fields,

‘and that applications by private persons to plant roads are often
‘meant merely to forestall genuine tree-planting by the Board.
‘The applicants get permission and plant trees that are not intend-
‘ed to thrive. It is hardly possible that so unsatisfactory a state
‘of things should have arisen without some reason for it in the
‘method of tree-planting adopted in this district. On wide roads
‘no serious damage to the fields need be apprehended if the trees
‘are properly placed. On narrow roads some care should be taken
‘in the selection of trees. Trees like the *Babul* can do no harm
‘in such places, and operations should be carried on so as to gain
‘the co-operation, not to arouse the opposition, of the rural popula-
‘tion.” And on this the Government remark:—“It is very desir-
‘able that the people should be taught to understand the value
‘of plantations of trees, and much might be done in this way
‘through the medium of District Board members. Where objec-
‘tions are raised, some reason for them will probably be found,
‘and when this is ascertained the objections could either be ex-
‘plained away, or met by a judicious selection of the kind of tree
‘planted.”

The financial results are not so bad as might be expected. The expenditure of the year was Rs. 72,229, while the revenue came to Rs. 41,937, partly from ‘lopping and felling’ and partly from ‘fruits, grass, etc.’ To judge by our own observations of lopping and pruning work done, some professional teaching is much wanted, but perhaps it is supposed in this, as in other forest cases, that anybody can do such work.

VI-EXTRACTS, NOTES & QUERIES.

The use of Sawdust in the Propagation of Plants by Cuttings.

The *Revue Agricole* of Mauritius contains an extract on a practical and interesting method of propagation by cuttings which should prove useful to horticulturalists. The writer states that though not generally accepted, the method described is one for which he has for many years abandoned all others, and from which he has derived the greatest satisfaction.

Silver fir sawdust is recommended as being the best for the purpose, but not being able easily to obtain it, the writer made use of the sawdust of poplar wood, which answered very well. This was first sifted to extract impurities and spread on the frame of the propagating beds in a compact well pressed layer about 3 to 4 inches thick. This is then well watered several times, stirring it about to ensure its complete saturation, in which operation the greater part of its

acidity also disappears. The next day it is ready to receive herbaceous cuttings of all kinds. An average temperature of about 58 degrees Fahr. should be kept up, and this amount of heat and a daily watering with about a gallon of water per square yard is all that is required to ensure the success of the cuttings.

Each square yard will take about 850 cuttings, which as soon as they have rooted, are pricked out into pots. In pricking them out, the sawdust adhering to the roots is gently shaken off, and the longest roots are pinched, or cut off with a pruning knife.

The same sawdust, provided it has not become too black, can be used again, occasionally it may be desirable to add a little fresh sawdust to the old layer.

The writer maintains that with such a system he has had the greatest success with cuttings of all sorts, the only exception being those of *Pelargonium*. One of the great advantages of the system is the economy of space, as the possibility of raising such a large number of cuttings in so comparatively small an area, renders numerous glass frames unnecessary.

A. F. G.

Monsoon and Trees

Mr. John Eliot's monsoon forecast is anything but encouraging, and it seems that in all probability, again, large tracts of the country will receive deficient rainfall. Meteorological conditions are matters of comparatively such exactitude in tropical climates that it seems a foregone conclusion that rainfall should be subject to fluctuations in fairly defined cyclical periods. Even the sun by periodic disfigurement of its face—so called "sunspots"—exhibits an undefined but evident concern in results. But when the country receives its normal quantum of rain, it remains a question as to whether it does so to the best effect. It is not sufficient that the rain rushes over the face of the country removing soil to be deposited in the making of delta land, or be carried fairly out to sea, or alter the course of rivers, or expose the bare rocks of the substratum ranges; it is essential that it shall go to swell the flow of subterranean sources. In various parts of the country, we have been met with the statement that water in wells formerly having a high water level, never now attains the height secured, say, 30 years ago. This cannot be the result of better opening up of subsoil drainage outlets; the tendency in the country has been, from opening of irrigation works and making of railway embankments, rather the opposite. To what then may this condition be ascribed? In our opinion one of the chief factors is the deforesting of the country which has occurred. The rapid flow off the soil is the natural sequel of its permeability being no longer aided by the roots of trees. The influence which forest growth has in this direction has been long recognized, and the most common illustration of the fact is the condition of a road after rainfall, where on one side there are trees, and on the other these are absent; the

longer continuance of moist soil on the side with the trees is readily remarked. Nor is it in this detail only that the existence of tree growth exhibits itself in modifying meteorological conditions. As the result of evaporation and heat radiation, the air above forests is usually cooler than in the open country, and there are in respect to certain trees of the turpentine tribe volatile matters, which are supposed to possess valuable antiseptic and medicinal properties. The increase of cost of firewood is also a matter that to the labourer is also a point of no little importance, and from the standpoint of political economy is of interest. The presence of shade, protection from dust, and effect on foul and damp soil afforded by trees near villages, are points of hygienic importance. It is true the Forest Department is now trying its best to overcome the difficulties into which past neglect has plunged the country; but there are certain areas that are so absolutely stripped of the slightest pretence to woodland, that it is almost hopeless under a very great lapse of time and unremitting effort, to hope for even partial recovery. Some effort beyond that of the Forest Department is requisite. In many parts of India it is considered a virtuous act by natives to plant fruit trees. Why should this not be taken advantage of? In America, they have felt the pressing necessity of staying the destruction of forests, attempting to replace trees which were in days gone by ruthlessly destroyed. To this end, there has been held for many years past a feast day, the so-called Arbor day, when schools, public bodies, and private individuals plant trees. To make this idea "catch" in this country it would be necessary to associate the Arbor day with some note of progress. In our opinion, one of most remarkable events for good or evil in connection with the administration of the country has been the enlargement of Legislative Councils, and the recognition of the right of the interpellations. If natives are in earnest in their appreciation of these symptoms of advance and liberty, it ought not to be difficult to secure the co-operation of District Boards and Municipalities in appointing annually a great "Arbor day" for each Presidency. As years rolled on, if in each of our towns and villages this movement were taken up, there would result, at no expense to Government, belts of trees near towns and villages of considerable economic and hygienic importance. (*Indian Engineering, August, 1894.*)

Myrica Nagi, Thun.

BY DAVID HOOPER.

Quinologist to the Government of Madras.

Among the large number of astringent drugs indigenous to the East Indies, the bark of the Boxmyrtle (*Myrica Nagi*) has been long known. This tree belongs to a small natural order placed between the Urticaceæ and the Casuarineæ, and grows in India, the

Malay Islands, China and Japan. The bark is collected in the sub-tropical Himalayas at altitudes of from 3,000 to 6,000 feet, and is occasionally exported in large quantities to the plains. It is used as a tan for fancy leather work, and in some districts it is employed for dyeing a peculiar pink ; but as it is kept in stock by the native drug shops in Northern India this would indicate its chief use as a medicine.

In Sanskrit works the bark is described as heating, stimulant, and useful in diseases supposed to be caused by deranged phlegm, such as catarrhal fever, cough and affection of the throat. But like most Eastern remedies the bark is mostly prescribed in the form of a mixture with other stimulants, alteratives and aromatics. Dr. U. C. Dutt speaks of the powdered bark being simply used as a snuff for catarrh with headache. *Kaiphal*, the Hindustani name of the drug, mixed with ginger, according to some doctors, is the best medicine for cholera. Hindus and Mohammedans use *Kaiphal* at the present day as an astringent carminative and tonic, and prescribe it for chronic cough, fever and piles. Mixed with vinegar it strengthens the gums and cures toothache. It will be seen that it is used where astringents are required, either as an external or internal remedy, but the large dose of 60 grains of the powdered bark is not the best method of administration.

About five years ago, Dr. Dymock sent me for analysis a sample of *Myrica Kino*. This substance occurred in a granular condition ; it was of a dark purplish-red color, hard and brittle when dry, and without any peculiar odor. It dissolved almost completely in boiling water, but a flocculent red precipitate separated when the decoction cooled. A tincture made with rectified spirit was of a fine, bright red color and very acid in reaction. The tannic acid gave a greenish color with ferric chloride, and was estimated in a cold watery infusion of the drug with a solution of plumbic acetate. The "Kino" had the following composition :—

Pure tannic acid	...	...	60·8
Insoluble in water	...	...	3·3
Moisture	...	...	9·8
Ash	...	...	10·8
Sugar, etc.,	...	...	15·3

Total . . 100·0

The large amount of carbonated ash left, on incineration, points to the probability of some of the tannic acid existing in combination with a mineral base, and this was really so. A large quantity of a substance readily reducing Fehling's test, is not a usual constituent of a natural astringent secretion like Kino, and I was relieved to find that the above substance had been prepared by evaporating a watery extract of the bark ; this would account for the mineral matter and the glucose.

The bark of *Myrica Nagi*, when collected from large trees, is about half an inch thick, extremely scabrous, pitted from the separation of pieces of suber, of a mottled rusty brown and dirty-white color, suber warty; substance of bark and inner surface of a dull red color; it yields a red color to water; taste strongly astringent. Examined microscopically, within the suberous layer is seen a remarkable stratum of stony cells: the parenchyma throughout is loaded with red coloring matter, and permeated with large laticiferous vessels, from which a gummy latex exudes when the bark is soaked in water.

Mr. J. Ishikawa (*Chemical News*, December 3rd 1880, p. 275) contributes a paper on materials containing tannin found in Japan, and from a substance named "Shibuki" bark (*Myrica rubra*) he obtained from 11 to 14 per cent. of tannin. If we may conclude that this tree is the *M. rubra*, Sieb. et Zucc., then it is synonymous with *M. Nagi*, Thunberg, the very tree under discussion.

A sample of *Kaiphall* bark from Bombay contained 11 per cent. of moisture and yielded 7.17 per cent. of ash. Estimated in the manner above mentioned, for tannin, it afforded 13.7 per cent. The lead compound of the organic acid contained 30.72 per cent. of oxide, a result which compares very closely with the amount found in the compound separated from the "Kino," namely, 31.88 and 30.36 per cent. in two estimations. The tannic acid, separated from the tincture by evaporation and treatment with water, gives a bluish-purple color with ferric chloride, but on adding this reagent to a decoction of the bark, a dirty green precipitate is formed.

Beyond determining the amount of tannic acid in an authentic specimen of this bark, and obtaining indications of an alkaloidal principle, I have not had opportunity for further examining the drug. It may on closer research be found to contain interesting crystalline principles, such as those recently separated from its neighbouring plants, species of the *Ficus* and *Casuarina* (*American Journal of Pharmacy*, May, 1894.)

Accident to Col. Bailey.

We regret to hear that Col. Bailey, R. E., so long Superintendent of Forest Surveys and Director of the Forest School, was one of the passengers injured in the Railway accident on the Highland Railway on August 3rd. The *Scotsman* says that he was standing up at the time of the collision, and sustained a rather severe injury to his neck and shoulders. His two sons, who were with him, were also bruised and shaken. He had to be left at Newtonmore, but was gradually improving, though he would be unable to go to Oxford for the meeting of the British Association, at which he was to be joint Secretary in the Geographical Section.

VII.—TIMBER & PRODUCE TRADE.

Statement of average selling rates of timber and bamboos in Meerut, Cawnpore, Bulandshahr, Bareilly, Pilibhit and Moradabad for the quarter ending 30th June, 1894.

Description.	Timber Scantlings per score.		Bamboos per 100 scores.		REMARKS.
	From	To	From	To	
MEERUT.					
Sal 10' Tors (Poles) ...	R. A. P.	R. A. P.	R. A. P.	R. A. P.	
Sal & Sain, &c., Kuries, 12' x 5" x 4" ...	10 0 0	20 0 0	...	...
Sal bed posts, 7' x 2½" x 2½" ...	25 0 0	38 0 0	...	...
Bamboos of 9' to 10' per 100 scores ...	12 8 0	15 0 0	...	...
	...	...	40 0 0	100 0 0	
CAWNPORE.					
Sal 10' Tors (Poles) ...	4 8 0	5 4 0	...	...
Sal, & Sain, &c., Kuries, 12' x 5" x 4" ...	20 0 0	60 0 0	...	...
Sal bed posts 7' x 2½" x 2½" ...	10 0 0	12 8 0	...	...
Bamboos of 9' to 10' per 100 score ...	...	...	30 0 0	60 0 0	
BULANDSHAHR.					
Sal 10' Tors (Poles) ...	...	...	...	...
Sal and Sain, &c., Kuries, 12' x 5" x 4" ...	...	...	...	...
Sal bed posts, 7' x 2½" x 2½" ...	...	...	...	...
Bamboos of 9' to 10' per 100 score ...	...	...	35 0 0	56 0 0	
PILIBHIT.					
Sal 10' Tors (Poles) ...	40 0 0	70 0 0	...	...
Sal & Sain, Kuries 12' x 5' x 4" ...	20 0 0	40 0 0	...	...
Sal bed posts 7' x 2½" x 2½" ...	5 0 0	6 4 0	...	...
Bamboos of 9' to 10' per 100 score ...	...	...	60 0 0	100 0 0	
BAREILLY.					
Sal 10' Tors (Poles) ...	5 0 0	10 0 0	...	...
Sal & Sain, &c., Kuries, 12' x 5" x 4" ...	25 0 0	35 0 0	...	...
	40 0 0	50 0 0	...	...
		60 0 0	...	...
Sal bed posts 7' x 2½" x 2½" ...	10 0 0	15 0 0	...	...
Bamboos of 9' to 10' per 100 score ...	...	...	50 0 0	137 0 0	
MORADABAD.					
Sal 10' Tors (Poles) ...	20 0 0	25 0 0	...	...
Sal & Sain, &c., Kuries 12' x 5" x 4" ...	30 0 0	50 0 0	...	...
Sal bed posts 7' x 2½" x 2½" ...	0 8 0	0 10 0	...	...
Bamboos of 9' to 10' per 100 score ...	...	...	50 0 0	75 0 0	

The Teak Market.

Messrs. Denny, Mott, & Dickson report deliveries from the docks in London last month were 706 loads, as against 1,372 loads for the corresponding month of last year. 389 loads were landed during the month, and stocks now show as follows :—

1894.	1893.
Loads.	Loads.
5,154 logs	7,782
2,006 planks	3,079
26 blocks	25
<hr/>	<hr/>
Total 7,186	10,887

or decrease of about 34 per cent. on last year's stocks in London.

The following are the comparisons between the past half-year and the corresponding one of 1893, *viz.*, from 1st January to 30th June.

	1894.	1893.
	Loads.	Loads.
Landings in London Docks	5,970	10,419
Deliveries from London Docks	5,958	6,648

showing a decrease on the half-year of nearly 43 per cent. in the landings, and fully 10 per cent. in the consumption.

The arrivals of teak to Europe for the half-year ending 30th June have been some 25,000 loads, as against 17,000 loads for the corresponding period of last year, showing an increase of about 32 per cent. for the half-year, which have been chiefly due to the hurrying forward of cargoes against the requirements of H. M. Admiralty.

The supplies afloat and chartered for arrival this year are practically the same as those provided for in the corresponding half-year of 1893. It will be seen from the above statistics that the supplies have been more than adequate to the needs of the market, owing to the falling off in the demand for consumption during the last three months, the improvement in the demand for shipbuilding shown during the first three months of the year not having been sustained, whilst the rolling-stock demand has been of the most restricted description since the autumn of last year. That the railways cannot indefinitely prolong the starving of their rolling stock is clear, and perhaps an improvement in this direction is nearer than is generally contemplated, and may be more logically hoped for than in the direction of shipbuilding, in the face of present low freights and the enormous supply of tonnage afloat. Were it not for the growing demand all over Europe for teak for naval purposes, the prospects of the market would be discouraging; but as naval "programmes," both here and abroad, tend to develop, the present level of prices may be sustained, if not improved upon.—(*Timber Trades Journal*, July 14th, 1894.)

Churchill and Sim's Circular.

August 8th, 1894.

EAST INDIA TEAK.—The deliveries for the first seven months of the year came out at 6,937 loads, as against 7,626 loads for the corresponding period of 1893. In July this year they were 886 loads, and in July, 1893, 1,062 loads. The London stock has diminished in the month, but the fear of heavy imports some time ahead keeps down prices. Probably these fears are exaggerated; the visible supply though distant, is large, but it is well accounted for by Government requirements in all parts of Europe, and the surplus should hardly overtax the regular commercial demand, feeble as that undoubtedly looks at the moment. The quality of some recent Burmese shipments has not given complete satisfaction, and rumours are current from Siam of difficulties with the flotation of logs to the coast to load vessels chartered.

ROSEWOOD.—Is of slow sale and stocks sufficient.

SATINWOOD.—For finely figured logs good prices could be made.

EBONY.—Large, good logs would realize fair prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to	£16
Satinwood	per foot superficial	6d.	to	12d.
Rosewood	„ ton	£5.	to	£8.
Ebony	„ ton	£6.	to	£8

MARKET RATES OF PRODUCTS.*Tropical Agriculturist, August, 1894.*

Cardamoms	per lb.	2s.	to	2s. 6d.
Croton seeds	per cwt.	20s.	to	27s. 6d.
Cutch	„	20s.	to	32s.
Gum Arabic, Madras	„	15s.	to	30s.
Gum Kino	„	£15	to	£18.
Indian Rubber, Assam,	per lb.	1s. 7d.	to	2s. 2d.
„ Burma	„	1s. 7d.	to	2s.
Myrabolams, Bombay,	per cwt.	7s. 6d.	to	9s. 3d.
„ „	„	3s. 6d.	to	4s. 3d.
„ Godavari	„	6s.	to	6s. 9d.
Nux Vomica, good	„	6s.	to	10s.
Orchella, Ceylon	„	15s.	to	22s.
Redwood	per ton	£3. 10s.	to	£4
Sandalwood, logs	„	£35	to	£55
„ chips	„	£9	to	£20

X.—EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.

2nd August, 1894.—No. 774F.—Mr. J. A. McKee, Conservator of Forests, Assam (on furlough), is transferred, in the interests of the public service, to the Central Provinces as Conservator of the Southern Forest Circle.

2.—MADRAS GAZETTE.

21st July, 1894.—Mr. J. Tapp, Acting Ranger, 4th grade, North Arcot District, to be Ranger, 4th grade, from 28th June, 1894.

31st July, 1894.—The following is the result of the Departmental Test held in July 1894 :—

Name.	Appointment.	District.	Subject in which passed.
C. Ramaswami Aiyengar ...	Temporary Forester, 2nd grade ...	Tanjore ...	Forest Act and Rules and Code and Accounts.
K. Kailasa Aiyar ...	Acting 3rd Clerk, District Forest Office ...	North Arcot	Forest Act and Rules.
V. M. Varadarajulu Naidu ...	Acting 4th Clerk, District Forest Office ...	Do.	Do.
J. S. Cornelius ...	Third Clerk, District Forest Office ...	Salem ...	Forest Act and Rules and Code and Accounts.
M. S. Arokyaswami Pillai ...	Forester, 4th grade	Do.	Forest Act and Rules.
A. Kaishna Row ...	Permit Clerk ...	Do.	Code and Accounts.
M. Ponnuranga Mudaliar ...	Forester, 4th grade	Nellore	Forest Act and Rules.
C. Balaya Naidu ...	Do.	Cuddapah	Do.
K. Ranga Row ...	Range Clerk ...	Salem ...	Code and Accounts.

2nd August, 1894.—A. P. Ramachandra Mudaliar, Ranger, 5th grade, sub *pro tem.*, to be Ranger, 5th grade.

Under orders of the Board of Revenue the services of Ranger Mr. J. Tapp are placed at the disposal of the Court of Wards for employment in the Jeypore Estate, Vizagapatam District.

S. Ramaswami Aiyah, Forester, 1st grade, to act as Ranger, 5th grade, sub. *pro. tem.*, vice Mr. Tapp on deputation.

31st July, 1894.—Under Article 291 of the Civil Service Regulations, S. Eggia Narayana Sastri, Acting Forest Ranger, 5th grade, Anantapur District, is granted 20 days' privilege leave, with effect from the date of availing himself of the same.

2nd August, 1894.—V. P. Ramalingam Pillai, Forest Ranger on Rs. 125, North Malabar Division, is granted leave on medical certificate, under Article 369 of the Civil Service Regulations, for three months from the date of relief.

CONCERNING THE .
ENHANCEMENT OF INCREMENT
WHICH TAKES PLACE IN
TREE - FOREST
AFTER
HEAVY THINNINGS OR PARTIAL CLEARANCE
FOR THE PURPOSE OF
PERMITTING THE TIMBER CROP TO HAVE A FULLER ENJOYMENT
OF LIGHT, AIR, AND WARMTH.

It is a well-known fact that when trees growing in close canopy are thinned out, or when in the case of old crops approaching maturity a partial clearance is made, the annual increment on each individual stem naturally rises in consequence of the decrease in the number of stems drawing food-supplies and moisture from the soil, and engaging in the struggle for light and air.

In the system of selecting only the largest trees for extraction, in standards over coppice, and in standard trees retained in high forest for a second period of rotation, such increment in growth is certainly attained; but in the following the question to be considered is mainly connected with heavy thinnings or partial clearance made shortly before a crop falls to the axe, in order to stimulate the remaining trees to more energetic growth in girth before the date at which the fall must take place according to the working-plan. It is, in fact, but the continuation of the thinnings that have taken place as measures of tending throughout the whole lifetime of the crop, only it is carried out more freely on account of this being the last thinning that is to be made before the crop attains its full maturity. If less than one-fifth of the total amount of timber on the area be removed the operation may still be considered as a *heavy thinning*, whilst if one-fifth or more of the crop be thus prematurely utilised it must certainly be considered a *partial clearance*.

That such measures undoubtedly do lead to a stimulation of the annual increment is a fact not only abundantly shown by

practical experience, but also proved more than half a century ago by the more eminent sylviculturists of Germany, C. Heyer, Th. Hartig, Nördlinger, and others. They showed conclusively that a stimulation of the increment on individual stems took place, as the natural result of all such thinnings as exceeded in degree the natural process of that struggle for existence in which the stronger first overtops and finally suppresses the weaker individual stems, whenever such free thinnings were made in forests growing in close canopy, and at an age not exceeding to any considerable extent the normal periods of rotation under which the species of tree in question was usually grown as a timber crop. Every now and again, however, some champion steps forward to dispute what have long been accepted as facts; but the plausible deductions drawn from his observations are always on closer investigation found to have some flaw. Thus, for example, he may have confined his attention to the bole only, or have neglected to discriminate between the direct effects of the freer enjoyment of light and air, and the adventitious circumstances under which the latter may have taken place, these concrete conditions being at times of such influence as to diminish or even counteract the intended results of the thinning or partial clearance.

There is generally some very easily determinable reason when this latter measure fails to produce more energetic increment. The thinning or partial clearance may, for example, have been carried so far as actually to have interfered with the normal functions of the root-systems and crowns of foliage of the individuals left forming the crop. These *nouveaux riches* may often require some little time to settle down and accustom themselves to their altered circumstances; and the first form in which this makes itself apparent is very frequently rather in the energetic formation of new roots and thicker foliage, which ultimately exert their due influence on the increment of the stem, than in the immediate thickening of the annual rings, or the formation of woody-fibrous tissue. And wherever the other main factors exerting influence on the productive capacity of the soil are not at the same time tended and well provided for, stimulated increment cannot always be expected as the natural result of diminishing the number of trees forming the crop. Thus, for example, care must be taken to prevent deterioration of the soil (where necessary by underplanting) in consequence of insolation and of the drying and exhausting effects of winds, or with regard to the soil-moisture and to the soil-covering of dead foliage requisite for the formation of humus or vegetable mould.

In one case, however, the current increment of the trees may be directly decreased at first in place of stimulated, namely, when the fuller enjoyment of light and air leads in the first instance to abnormal increase in the production of seed in consequence of a tendency to the formation of albuminoid substances in place of carbonic hydrates,* as is especially liable to take place in the case of trees that were already predominating throughout the canopy at the time of the partial clearance being made. And, of course, if the partial clearance be carried too far, the increment on the remaining crop is injuriously affected by the natural consequences resulting from over-exposure of the soil to insolation and the action of winds, and from exposure of the stems themselves to sunburn or scorching of the bole in smooth-barked species, to increased danger from windfall and insects, as also to the greater damage apt to be done during the felling of the stems to be removed, and the grubbing up of their stumps.

Theodor Hartig was the first to assert† that, as the direct and immediate consequence of freer enjoyment of light and air, without reference to the species of tree, stimulated increment on each individual tree invariably took place, though subject to the influence of the other factors determining the rate of growth. When any apparent exceptions to this rule take place, they are neither ascribable to differences in the species of trees, nor to differences in respect of soil and situation, but are solely due to one or more of the above-indicated causes. Species of timber, soil, and situation certainly exert their influence as regards the extent to which increment may take place, but are not of themselves the direct or prime cause; there is, however, good reason to believe that deciduous trees are enabled by nature to avail themselves of the direct and immediate increment to a somewhat greater extent than the coniferous trees which retain their foliage throughout the whole year.

The enhanced increment need not assume the form of broader annual zones of woody-fibrous tissue along the bole, but may, and very often does, at first take the shape of considerable changes throughout the root-system and the crown of foliage, primarily and undoubtedly due to the freer enjoyment of light, air, and warmth; this paves the way for the succeeding form of enhanced increment, due to these changes in and increment of the assimilative organs, which makes itself more readily distinguishable throughout the stem and branches.

* Rinicker, "*Der Zuwachsgang in Fichten-und Buchenbeständen*," 1886, page 30.

† "*Lehrbuch für Förster*," 1861, Vol. I., page 105.

The extent to which the annual increment thus becomes enhanced varies in any particular species of tree according to the individual stem, its age and reproductive capacity, the soil, situation, and exposure on which the crop grows, the density of the canopy throughout the crop, and the development of the crown of foliage borne by the individual stem. The younger and sturdier the tree, the better developed its crown, the more favourable soil and situation may be to the thriving of the particular species of tree, and the denser or more crowded the wood, so much the more likely is the influence of the thinning or partial clearance to be readily observable. That the extent to which it is perceptible varies in the different species of our forest trees has been above indicated and really requires no explanation. Thus, for example, oak, pine, and larch that have been grown in pure forests, in which there is a strong tendency for the trees to thin themselves naturally to such an extent as to make the canopy loose, if not broken, and to allow of each individual stem forming a larger crown than is usual in the case of shade-bearing species like beech, spruce, and silver fir, can hardly be expected to derive so much benefit as the latter from an artificial diminution of the number of stems per acre. In many such cases indeed this natural thinning, especially when the oak, larch, and pine are approaching the time of maturity of the crop, may have proceeded so far that any further artificial clearance might lead to diminution instead of enhancement of the increment of the remaining stems in consequence of deterioration of the soil, unless underplanting take place at the same time in order to improve, or at any rate protect, its productive capacity. As it is well expressed by Gayser,* the founder of the modern school of scientific silviculture,—

“Whenever the partial clearance is likely to lead to interruption of the canopy of the crop, it should only be carried out when the productive capacity of the soil is such as promises in all its essential factors to supply continuously the increased demands made in consequence of greater energy in the crown of foliage (transpiration and assimilation), *i.e.*, that the soil in question is fertile, or that care may be taken to stimulate the productive capacity of the soil in some suitable way at the proper time. This can only take place through the maintenance of a good layer of humus and the careful retention of soil-moisture, and consequently in many cases only by means of *underplanting* in order to protect the soil against sun and wind.”

But in the case of the shade-bearing species, beech, spruce, and silver fir, which (except in cases of accident) remain in dense canopy throughout their whole period of growth, right up till their normal maturity, the effects of the freer enjoyment of light,

* “*Waldbau*,” 3rd edition, 1889, page 571.

air, and warmth procured for the individual stems by heavy thinning, or by partial clearance when they approach the prescribed time of fall, are often during the first year marked by a two-fold to ten-fold increase in the breadth of the annual zone of woody-fibrous tissue.* This stimulation of increment can also in the case of these trees be attained with a far less degree of clearance, so that, with proper care, there need be small danger of the soil being in any way injuriously affected owing to the partial and temporary interruption of the canopy to a slight degree, a fact easily explained by the lesser absolute measure of light and air enjoyed by these shade-bearing species when grown in canopy of normal density.

Thus, whilst the laws regulating the increment in all species of forest trees are substantially constant, the extent to which the enhancement of increment takes place after partial clearance has, so far as observations have yet been recorded, been found to be practically in the inverse ratio to the requirements of any particular species in regard to light and freedom of crown.

THE CAUSES OF THE ENHANCED INCREMENT EXPLAINED.

Various causes have been assigned to the effects produced in enhanced increment after partial clearance.† Th. Hartig considered it to be due rather to the utilisation of reserves of productive matter collected and stored up in the stem whilst it stood in close canopy, than to any increased assimilation in direct consequence of the increase in foliage that takes place when the individual tree obtains a larger growing space; whilst Nördlinger, on the other hand, ascribed the enhancement in increment to the increase in the foliage, but laid particular stress upon what he considered the fact, that the enhancement was not so much the direct result of the increase in the mass of foliage as of the stimulated assimilative activity of the leaves and needles, with simultaneous temporary increase in the productive capacity of the soil.

The correct explanation as to the enhanced increment is probably to be found in a combination of these views, for it is much more than probable that the utilisation of the reserves of productive matter (principally starch in various forms) is most likely greatly favoured by the more active assimilation of nutrients whenever the increase in the foliage takes place, and

* Grasmann, "*Beitrag zur Lehre vom Lichtungszuwachs*," 1890, page 9.

† Grasmann, *op. cit.*, page 4.

approaching maturity is to be found in the stimulus to the formation of starchy matter afforded by insolation, the degree of activity of the assimilative organs being dependent on the purity or brilliancy of the rays of light, as the decomposition of the carbonic acid in the atmosphere can only take place when the waves of light attain a certain length. Whilst a crop is growing in full canopy the assimilative activity of the foliage forming the lower portion of the crown is extremely small owing to the low quality of the diffused light which is alone available, but when the canopy is opened up to a sufficient extent these portions of the lower foliage, which have been practically inactive, or may perhaps even have been existing on the work done by the upper leaves or needles, reassume their normal assimilative functions and help to enhance the general increment of the tree. And besides this increased assimilative power of the foliage, the consequent increased formation of new leaves and needles is undoubtedly of enormous influence in maintaining and increasing the general enhancement of increment throughout the stem. As remarked by König,* the direct result of the free enjoyment of light and warmth leads to the better and more energetic development of the leading-shoots, the strengthening of twigs, and the formation of twigs from buds that would otherwise most probably have remained dormant.

The enhanced increment continues until the crop once more forms close canopy, but if again stimulated by a repetition of the thinning out or partial clearance this may—if not accompanied by underplanting—be carried on so far as to involve deterioration of the soil to such an extent that the beneficial influence of light and warmth on the crown is cancelled by the diminished activity of the root-system, involving consequently decreased supplies of moisture and of mineral nutrients for conveyance to the assimilative organs.

The simultaneous underplanting of crops subjected to this system of partial clearance, and especially of those of light-demanding species of trees,—oak, ash, maple, larch, and Scots pine,—has an undoubtedly stimulating result in effecting and maintaining the enhancement of increment after partial clearance, and is of particular interest from the financial point of view. The influences exerted by soil and situation, and by the age of the crop, exhibit themselves rather with regard to the extent of the enhancement in increment than to its production and continuance; for unless the individual trees are already far past their normal

* "*Ueber Lichtungszuwachs, insbesondere der Buche*," 1886, page 7.

maturity, and already show signs of the loss of energy in growth due to a foreshadowing of the approach of senile decay, such also receive a fillip from admission to larger growing-space and freer enjoyment of light and warmth. When, however, the vital energies of the trees are weakened by age or disease, normal enhancement of increment must not be looked for, the circulation of the sap throughout the stem being already to a greater or less extent interfered with, whilst the root-system is also unfitted to discharge the extra duties it is called upon to perform. Trees that are not very far past the period at which their current annual increment has culminated, as well as such as have not yet attained the culminating point, are, however, unquestionably stimulated to livelier energy, which manifests itself in enhanced increment. But in practice this system of partial clearance for the speedy formation of the more valuable assortments of timber is seldom applicable to very young woods, or to crops that are already much older than the usual periods of rotation. It generally finds proper scope only in mature crops of high forest and in those approaching maturity; and in these cases the age of the crop has little influence on the length of time throughout which the enhancement of increment is maintained, this being determined rather by the length of time which it takes the crop to form close canopy once more. The nature of the development of the crown is, however, of greater importance than the age of the crop, for if the previous thinnings have been neglected, and the canopy has been allowed to remain so dense that the woods are crowded, it often happens that on receiving increased growing-space the trees with their weakly crowns are unable to avail themselves of the advantages thereby offered, and exhibit, as may so often be seen in the case of oaks, a tendency to the development of dormant buds, which leads to "*stag-headedness*" or death of the crown, and malformation of the bole.

PRACTICAL ADVANTAGES OF THE METHOD OF PARTIAL CLEARANCE.

From the practical silvicultural and the financial points of view such heavy thinnings or partial clearances should not be made until after the crop in question has completed its chief growth in height.

Along with the other advantages of natural reproduction under parent standards, the rapid increment in timber, as well as in the technical and financial value of the latter, which takes place

after partial clearances for the purpose of regeneration, has drawn considerable attention to this method as a system of treatment of woods, even when their artificial reproduction,—as in the case of oak, maple, larch,—may generally be considered more advisable than natural regeneration. The favourable returns received from the gradual clearance of parent standards in the case of natural reproduction of beech, and of silver fir in particular, as well as the financial advantages that accrue ultimately from the partial clearance and underplanting of indifferent crops of oak, larch, and Scots pine when they approach maturity, have to a great extent dispelled the prejudices that existed against the system in the minds of some as being entirely inconsistent with the natural course of things, and have won for it recognition as a method of treatment worthy of adoption wherever circumstances admit of its practice. There seems little doubt that in the near future it will be carried out to a much greater extent than at present, as it combines most of the advantages of standards over coppice with decided silvicultural and financial advantages of its own. Thus, for example, by means of this method of partial clearance the larger and more valuable assortment of stems can be produced in a shorter time, *i.e.* at a less cost, whilst instead of a high forest of normal density composed of nearly mature trees, with an average annual increment long past their point of culmination and gradually sinking, an equal and often a greater annual increment per acre is attainable after the partial clearance, paying as well, and often better, than if the full crop had been allowed to attain maturity, besides yielding substantial returns from the timber prematurely utilised. When in natural reproduction the gradual clearance of the parent standards is effected, it is in no way inconsistent with what has been above said if, before the formation of the young crop, the average annual increment of the standards is below that of normal high forest reproduced by total clearance and sowing or planting, seeing that from the time the young crop may be considered formed onwards the enhanced increment on the more or less isolated standards is undoubtedly more favourable financially than when total clearance is followed by artificial reproduction.

That portion of the fixed capital which is represented by the growing crop is considerably reduced by means of the partial clearance, and the money thus derived as intermediate returns can be otherwise utilised in order to yield interest for itself, whilst the material left standing increases in the percentage it affords. Thus, if the partial clearance amounts to one-fifth, or

one-third, or one-half of the total crop in close canopy, it has been satisfactorily proved by several authorities* that the enhanced increment on the area partially cleared at least equals, and often exceeds, the total previous current annual increment, notwithstanding the diminution in the number of trees thereafter forming the crop.

The financial advantages derivable are thus summarised by Grasmann† :—

- (1.) The larger and better-paid assortments of timber can be produced in shorter time, and therefore more cheaply, by this method.
- (2.) Instead of the full crop, with small annual increment on a larger number of individual stems, three factors are favourably introduced and combined, viz. :—
 - (i.) Good intermediate returns are available, capable of producing interest for themselves.
 - (ii.) The enhanced annual increment on the remaining crop equals, and often exceeds, that produced by the full crop previous to its partial clearance.
 - (iii.) The naturally or artificially produced young crop under the parent standards often practically equals in increment a young crop formed artificially by sowing or planting.

What Loudon says‡ of the oak may be applied to all our forest trees grown as crops with a view to remunerative returns from the capital invested :—

"The age at which oak timber ought to be felled, with a view to profit, must depend on the soil and climate in which the tree is grown, as well as on other circumstances. Whenever the tree has arrived at that period of its growth, that the annual increase does not amount in value to the marketable interest of the money which, at the time, the tree would produce if cut down, then it would appear more profitable to cut it down than to let it stand."

Whilst this is perfectly correct for each individual tree grown in the comparatively isolated positions that timber trees usually occupied in Britain at the time the above was written, it in no way precludes the possibility, which in fact we know from actual experience to be the case, that when the current annual increment per acre has sunk below the point up to which it is not

* Wagener, "*Der Waldbau und seine Fortbildung*," 1884, page 208; Kraft, "*Beiträge zur forstlichen Zuwachsrechnung*," 1885, pages 99 *et seq.*

† *Op. cit.*, page 11.

‡ "*Arboretum et Fruticetum Britannicum*," 1838, Vol. III., page 1809.

unprofitable to allow a crop to remain in the full normal canopy of its species, it can be stimulated and rendered more profitable, often very considerably so, by the above-indicated method of partial clearance with a view to the earlier production of valuable stems of large girth. In regular high forest, with natural reproduction, the time of regeneration is often, in order to attain good boles of valuable dimensions, prolonged till after the period when energy for the formation of seed or the natural reproductive capacity is already somewhat weakened. By means of partial clearances, however, the regeneration can be favoured during the chief natural seed-producing period of growth, whilst, at the same time, as good dimensions of timber may be obtainable as in the regular high forest, and in a more profitable manner. Thus, for example, in the reproduction of spruce in sheltered localities, where windfall is not likely to occur, and where the period of reproduction may be taken to be usually about 100 years, if partial clearance be made about the 70th year, during the time of the most active production of seed, the financial position of soil plus crop during the succeeding 30 years will almost, beyond question or doubt, be much more favourable than if the crop had been allowed to stand as regular high forest till the full period of rotation originally fixed in the working-plan had been attained; for it is almost certain that the partially cleared crop will contain a relatively higher number of boles of valuable assortments than would have developed themselves under the system of regular high forest. And what is said here in regard to spruce is still more applicable in regard to the other two great shade-bearing species, the silver fir and the beech. The whole system is in fact merely a modification of and improvement on the old system of natural reproduction under parent standards; but whilst in the latter case the seed fellings (partial clearances) before and during the time of seeding, and the gradual clearances after the formation of the young crop took place mainly with the object of effecting natural regeneration, the partial clearances under the new method are made with the distinctly avowed intention of stimulating the standard crop to enhancement of the annual increment, and to the yield of more favourable returns from the capital represented by soil and growing crop. In the former case formation of a young crop was the motive, and enhanced increment on the parent standards the effect; in the latter, enhancement of annual increment is the object, and simultaneous natural reproduction of shade-bearing species the result of this sylvicultural operation.

RULES FOR THE CARRYING-OUT OF PARTIAL CLEARANCES.

With the light-demanding species of trees, when they are not grown in mixed forests along with shade-bearing species, underplanting is almost a necessity after heavy thinnings or partial clearances, in order to maintain the productive capacity of the soil. The manner in which this method of treatment is applied to the various chief species of our light-demanding forest trees—oak, pine, and larch—is as follows:—

Oak.—When pure forests of oak have passed through the regular processes of thinning, and approach the time for partial clearance taking place, their canopy is in general somewhat light and thin, although perhaps not broken, and the undergrowth is usually already beginning to form canopy for itself below the older crop. To avoid the formation of twigs and shoots from the dormant buds along the stem, often leading to “*stag-headedness*,” the partial clearance should not be made by one fall, but is better attained by one or two heavy thinnings conducted to the extent deemed advisable for each individual crop. The time at which it should take place is also dependent on the special circumstances of each crop, but chiefly with regard to the time of underplanting and the development of the undergrowth, the energy of growth of the trees, and the nature of the soil and situation. As, however, the efficacy of this method of treatment is all the more apparent the earlier it can be begun, the thinnings should, if possible, be commenced about the 40th to 60th year, being at first confined to the young stems of backward growth, and to such as are never likely to attain good marketable shape. The oftener the thinnings can be repeated at short intervals the better, as any sudden exposure of the boles should be carefully avoided.

About 10 or 15 years after these preliminary operations have been begun, the main partial clearance will in most cases seem advisable, for by that time the crop should be in a state of active increment, due to the favourable influences of the undergrowth and the previous thinnings. Here, again, as also whenever further partial clearances are considered necessary later on, the fall is in the first instance confined to trees that have been damaged by organic or inorganic agencies, or that do not continue to yield satisfactory increment; and not until all such unremunerative material has been removed should sound trees in energetic growth be cut out.

When the main partial clearance has taken place about the 70th year, and has been followed by minor gradual clearances at

intervals of five years at first, then of 10, and later on of 15, the preliminary yield or intermediate returns thus obtained amount according to Kraft,* respectively to about 288 to 628 cubic feet, then to 720 to 1,080 cubic feet, and ultimately to 1,800 cubic feet per acre, inclusive of brushwood. Past experience seems, according to Gayer,† to justify the hope that by this method of treatment the same dimensions of bole can be attained in about 120 years as are obtainable in pure forests worked with a rotation of 200 to 240 years, provided that up till about the 100th year the rate of increment has been maintained at 3 to $3\frac{1}{2}$ per cent., and after that at 2 to $2\frac{1}{2}$ per cent., conditions which are quite conformable with the actual results obtained on suitable soils. The crop of oak then ultimately harvested numbers about 36 to 48 stems per acre, which on good soil yield valuable and well-paid assortments of timber.‡ Where soil and situation are good enough to fulfil the demands made on them, there can be little doubt that this system of underplanting with a shade-bearing species, and partially clearing the main crop from time to time, is the one best calculated to produce timber of highest value for technical purposes, and to yield the most favourable returns financially from the capital represented by the soil, together with the growing crop.

Scots Pine.—For the practice of this method a good deep soil is necessary, as it differs essentially from the custom, common on poorer qualities of soil, of *thinning out crops during* their 20th to 50th year of age and underplanting them with spruce or other suitable shade-bearing species. In the latter case they are often allowed to grow on to maturity without any further thinning or interruption of the canopy to speak of; but though they continue to improve in growth and form, this is due to the beneficial influence of the undergrowth both on the soil and the standards. As a good formation of the crown is requisite for

* "*Aus dem Walde*," Vol. IX., page 80.

† *Op. cit.*, page 574.

‡ The following passage from Loudon's work already quoted (page 1809) is interesting, although not quite intelligible as regards "*the largest scantlings*" being produced at 130 years of age, though if "*larger*" be read in place of "*the largest*" the statement readily becomes intelligible:—

"A writer in the *Gardener's Magazine* states that Mr. Larkin, an eminent purveyor of timber for ship-building, stated, when examined before the East India Shipping Committee, that, in situations the most favourable for ship timber (the Weald of Kent, for example), the most profitable time to cut oak was at 90 years old; as, though the largest scantlings were produced at 130 years' growth, the increase in the 40 additional years did not pay 2 per cent. (*Gard. Mag.*, Vol. XI., p. 690.)"

Scots pine in order to enable it to continue for a long time in active energetic increment, thinnings should be made towards the end of the pole-forest stage of growth, and afterwards repeated whenever there seems any danger of the crowns interfering with each other. Underplanting should also be here carried out as soon as the thinnings have taken place with a view to the formation of good individual crowns. By this means, in place of having a pure forest formed, according to Weise's Yield-Tables,* on soil of average quality at 80 years of age by 317 stems per acre, having a mean average girth of 29 inches at breast-height, which would only be attained by about 40 per cent. or 127 stems, with a form factor of 0.45 and a current annual increment of only 44 cubic feet per acre, it can hardly be doubted that a smaller number of trees with enhanced increment and the finer dimensions of stem effected by the comparatively rapid thickening of the bole at the top end must yield more favourable financial returns on the capital invested in timber production. Reliable comparative data are, however, unfortunately not yet available.

Larch.—In regard to general treatment by partial clearance with a view to the speedy production of large-girthed timber the larch has much in common with the oak; but the underplanting may sometimes take place more advantageously with the silver fir than the beech. So far as experience goes this method of treatment is well adapted to the cultivation of the larch on good, deep soil, and is most satisfactory when the partial clearance and underplanting takes place as early as the 25th to 30th year. When the previous tending of the plantations has been good and the thinnings have been regularly made, the main partial clearance can be heavier than in the case of the oak, so that subsequent clearances are often almost unnecessary. On good soil from 60 to 70 trees per acre remain to form the final yield of the standard crop; and wherever soil and situation are at all suitable for the growth of larch, 60 or 70-year-old crops can often yield an increment of 3 to 4 per cent. up till that age, when they already show good marketable dimensions.

As the beech is not in favour or demand as a timber-tree of large dimensions, this method is only apt to find any practical application with the spruce and the silver fir among shade-bearing species; and as they show many points of similarity,

* "*Yield-Tables for the Scotch Pine*," translated by W. Schlich, Ph.D., 1888, pages 18 and 19.

they may be considered together. Where, however, there is any likelihood of windfall or damage from storms, this method is totally unsuited for the spruce.

Spruce and Silver Fir.—The way for partial clearance should be paved by preliminary operations carried out about the 25th to 30th year in such a manner as to let the predominating poles have a clear space of 2 or $2\frac{1}{2}$ feet around the crowns, these favoured individuals standing about 15 to 17 feet apart, and all the rest of the crop being thinned out in the ordinary manner customary in pure forests without interruption of canopy. During the 30th to 50th year, when the influence of this measure has made itself apparent in the re-formation of close canopy, the main partial clearance takes place in somewhat similar manner, the stems between the favoured individuals being freely thinned so as to permit of the formation of an undergrowth either naturally, or where necessary artificially, wherever the minor portion of the crop is of itself insufficient to protect the productive capacity of the soil. When the favoured stems have at breast-height a girth of about 36 to 40 inches, which they should attain between the 60th to 80th year, the marketable trees can then be gradually cleared away on the same principle.

Another method, practised in the neighbourhood of Salzburg in Western Austria in mixed forests consisting of spruce, silver fir, and beech, consists in carrying out the thinnings once every 10 years after the crop has attained 30 years of age, and making them heavier each time the operation is repeated, until the main partial clearance is made about the 60th or 70th year, leaving 120 to 160 stems per acre, all of them conifers and in energetic growth. Under such a crop natural reproduction can easily be effected; so that about 20 years later the standard trees are of large marketable dimensions, whilst the young growth may vary from 5 to 15 feet in height. On the removal of the standards the blanks thus formed in the new crop can easily be filled up artificially, and may be advantageously utilised for the formation of mixed forests by the introduction of other species.

Actual measurements of crops thus treated are not yet available for comparison with the yield-tables published for pure forests, but the approximate data already given may be contrasted favourably with the more accurate information contained in these latter. According to v. Baur, pure forests of spruce of 120 years in age and growing on good soil have 288 stems per acre, the mean girth of which at breast-height is 39 inches, but this is only attained or exceeded by about 40 per cent. or

115 stems ; the mean average stems have also been found to have a form-factor of 0·48, which is undoubtedly lower than that of stems treated by the method of partial clearance. Again, according to Lorey, the silver fir, when grown in pure forest on good soil, yields 200 stems per acre with a mean girth of about 52 inches at breast-height, which also is only attained by about 40 per cent. or 80 stems per acre.

As has already above been pointed out, this method of partial clearance with the distinct object of stimulating the remaining crop to the speedy development of the larger and better-paid assortments of timber cannot be successfully attempted with regard to any species of tree when once its natural energy of growth has practically abated to any considerable extent, or on the poorer classes of soil ; but wherever the trees are still capable of stimulation in respect to increment, and the productive capacity of the soil can be easily safeguarded against deterioration, the method has decided practical advantages which should strongly recommend themselves to the woodland proprietors of Britain, where sylvicultural operations on any extensive scale should only be conducted on strictly financial principles.

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Note on the use of Simul wood for Tea boxes
in Assam.

The wood of the Simul tree (*Bombax Malabaricum*) is used extensively in Assam for tea boxes, as the following figures prove :—

Number of boxes on which royalty has been paid during the Forest year, 1893-94 :—

Lakhimpur division	2,48,816
Sibsagar „	29,572.
Darrang „	89,935.

Total 368,323.

During the same period of 1892-93, the number of boxes on which royalty was paid amounted to 322,676, and in 1891-92 the number was 303,924; these figures show a steady increase, but they do not represent the total trade in tea boxes, as in some districts trees are sold for this purpose, and some boxes are made from timber on private estates, as explained in the Forest Administration Report for 1892-93, para. 95.

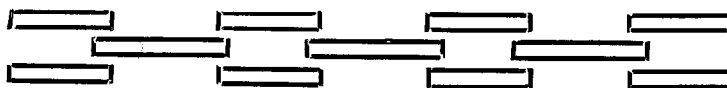
In the Lakhimpur division there are six saw-mills constantly at work: (1) Mukla, (2) Sissi, (3) Oriental, (4) Balijan, (5) Bokel and (6) Tapajan. In the Sibsagar division, on the left bank of the Dehing river, there are two mills, (1) Hopewell and (2) Dehing; and in the Darrang division, there is a branch of the Sissi mills at Tezpur.

The Sissi Saw-mills and Trading Co., Limited, being the largest of those concerns, may be taken as a type. They work on what is called the "box royalty" system which may be briefly described as follows :—The Manager of a mill is supplied by the forest office with permit books, and he issues permits to contractors to fell Simul trees in the unclassified State forests within the

division. The trees are felled and logged during the cold weather, and are floated down during succeeding months to the mills, which are all situated on waterways. The larger the girth of the log the better for the mills, the length is generally 8 to 10 feet. The rafts of logs are kept in the water until they can be sawn up. The logs are first ripped up in a frame saw, and then pass through a variety of circular saws until they emerge as "shooks," i. e., the actual pieces of which the box is constructed. These "shooks" are of varying widths and lengths to suit the different sized boxes, which are classified as follows:—*Large*, $24'' \times 20\frac{1}{2}'' \times 20''$ outside measurement; *Medium*, $22'' \times 19'' \times 18''$; *Small* $20'' \times 16'' \times 16''$, and $18'' \times 15'' \times 15''$; also *cubes* $16''$ inside measurement. The Sissi saw-mills also prepare boxes of the Japanese size $24'' \times 20'' \times 19''$; and special sizes are cut to order at an enhanced rate of two annas a box. The prices charged at the branch saw-mill at Tezpur, which is situated on the Brahmaputra, are, for large boxes, 14 annas each; for medium 12 annas; and for the small boxes and cubes 8 annas. Corner pieces, and battens are supplied free of charge with each box.

The method of seasoning is as follows:—First, the logs themselves remain in the water for two to three months; if they are kept longer in the water they develop a peculiar unpleasant odour, which is got rid of with great difficulty even when the logs are cut up into shooks. It is found impossible to season the logs on dry land as they soon rot; so the general plan is to saw them up soon after their arrival at the mill, when they have perhaps been in the water one, two, or three months according to distance, number of logs in stock, &c.

Directly the "shooks" are sawn up they are stacked on end out in the open, four together, and turned every now and then for a fortnight, by which time, if the weather has been fine, they are quite dry; and they are then stacked in an open shed, so that air can play between them in the following manner:—



Even with these precautions, if the boards are kept stacked for any length of time, they develop dry rot to an alarming extent; and they are also liable to be attacked by a small beetle locally known as the "Ghong," which is probably a species of *Bostrichus*. The only remedy for the latter is to watch the stocks, and remove any boards which show signs of the insect, and burn them. For the former there is no remedy. Consequently, the object of the mill Manager is to get rid of his boards as soon as they are sufficiently seasoned. In the busy months, June, September, there is no difficulty in this, as the indents received

keep the mills at work from 17 to 18 hours a day, and the difficulty is to supply tea gardens fast enough. But before these indents come in, a large stock is liable to accumulate, and there is always a good deal of loss.

In case of emergent indents, boards are sometimes despatched from the mills before they are thoroughly seasoned, and in this case a warning is sent with the consignments, and a careful garden Manager will unpack them at once and subject them to further drying in an open shed. But as a rule only seasoned "shooks" are despatched from the mills, and they can be made up into boxes at once. At the time of despatch the shooks are tied up into bundles, containing sufficient boards for four boxes, but this rule is not invariable.

It is not considered advisable to place the boards in water, this always discolours them, and planters would reject them. The best plan is to keep them perfectly dry, in a well ventilated shed, and to use them as soon as possible after they are once seasoned; one month is quite sufficient for this process, and there will seldom be any "cheesy" odour about the boards if the above precautions are attended to.

The saw-mill managers distinguish between *red* and *white* Simul wood; the former, known locally by the natives as the male tree, gives the best boxes, but it takes a little longer to season; the latter, known as the female tree, is also used, it is said to have a more open grain and to season more quickly.

Occasionally logs of other woods are brought in by mistake for Simul, and some of these have a most unpleasant odour like rancid butter, notably a wood called "Kaddam" or "Makai," a specimen of which has been sent to the Director, Forest School, for identification.*

The Mill Manager's books are open to inspection, and are frequently inspected by the Forest officer, and a statement is supplied every 10 days or so, shewing the—

No. of logs received and sawn up daily.

No. of boxes turned out daily.

No. of boxes delivered daily.

Payments are made to the Forest Office on "deliveries" (*i. e.*, boxes despatched) at the following rates :—

Large boxes at	1	anna each
Medium ,,	9	pies
Small ,,	6	pies

Scantlings @ 1 An. 3 pies per c. ft.

The total revenue received from this source in Assam during the forest year 1893-94 was Rs. 20,016.

* *Note*—It has proved to be the wood of *Anthocephalus Cadamba*, a tree whose wood certainly had no previous reputation of the kind.—*Hon. Ed.*

There is no doubt that well seasoned Simul is a favourite material among the tea planters for boxes, and as the tree is very fast growing, there is not much chance of the supply being exhausted just yet, though the contractors have to go further and further from the mills every year.

A. SMYTHIES.

The above was received from the Inspector General of Forests who has been making enquiries on the subject of the use of 'Simul' wood and other woods for tea boxes. He has also sent us a letter from Mr. Fordyce now in charge of the Andamans Forests, who writes as follows :—

Most of my experience regarding the use of Simul wood for tea boxes was gained in Assam, and I had a good deal to do with inducing the planters to set up the saw-mills now existing in the Lakhimpur District. Neither planters nor the owners of saw-mills are very particular what wood is used for tea boxes, as long as it fulfils certain conditions. The following are some of the woods I have seen used :—

Simul (*Bombax Malabaricum*), Raghuo (*Anthocephalus Cadamba*), Sontiana (*Alstonia scholaris*), Hollong (*Dipterocarpus pilosus*) &c., &c.

Hollong is one of the woods that, if not thoroughly seasoned, has an acid reaction on the lead, forming a white precipitate, and ultimately entirely destroying it. The chief wood used in the biggest saw-mill was Simul.

For the Sissi mills contractors fell chiefly Simul, it is cut along the banks of the Brahmaputra river, and thrown into the water, where it is made up into rafts and floated down to the mills. Here the timber lies in the water until required for cutting up. It is then taken straight into the mills and cut up into shooks of the required size. These shooks are then taken off to a long thatched drying or seasoning shed, where they are packed carefully with spaces between each shook, so as to allow the air to circulate freely between the boards.

If the weather is fine these shooks are often taken out and stood on end in threes or fours in the open air. After the shooks have undergone this process for a certain time, they are put into bundles, tied round with cane, and despatched to their destination.

On arriving at their destination some planters, I believe, open out the bundles, others leave them as they arrive, until required for making into tea boxes.

It is very hard to say how long the Sissi saw-mills keep their logs in the water before sawing them into shooks. This depends a good deal, if not entirely, on the supply of timber they may have in hand; and I feel quite certain that it is not for seasoning purposes, but purely as a matter of convenience that they are

left in the water ; as situated where they are, they can in most months float the timber right up to the mills, and this facilitates the handling of big logs enormously. However, on an average, I should say their logs were in the water at least a month before they are cut up.

Then again arises the question how long the shooks are in the process of drying and seasoning before they are despatched to their destination. This time again varies. At the slack time of year, the shooks will be kept under this process longer than in the busy season, when, very often there is a sudden demand for boxes, when the drying process is reduced in time as much as possible.

My estimate of the time the shooks are drying and seasoning is from two to four weeks in the Sissi saw-mills.

At other saw-mills, *i. e.*, "Planters' Stores" and "Dehing" saw-mills, I have seen "Simul" logs taken out of the water immediately they arrived, and put through the mill and cut up into shooks. This timber could not have been in the water a week, and probably only two or three days. The latter saw-mills were often very hard up for timber, and in many cases their shooks must have been despatched to their destination after only three or four days' seasoning and drying.

Again I would mention the case of Mr. Peal's mills. Situated as they were, timber could not be rafted to them. The timber (Simul) for these mills was dragged direct into the mills, so that the logs were never in water at all. Here the logs were stacked close to the mill, and were very often cut up more or less green, and the shooks seasoned in a drying shed.

I have never heard of "Simul" being cut up into planks and then being put into water. I don't think any advantage would be gained by doing this.

In the Andamans we use what is said to be "*Bombax insignis*" for cutting up into boxes for the local tea garden. The logs we use have been in depôt for two years or more, Chester having used them for floating down "*Lagerstræmia hypoleuca*" and "*Pterocarpus Indicus*." These logs are not sound, and ever since they have been in depôt, they have been constantly submerged at high tide. We take these logs over to the mill, floating them over, cut them up at once into shooks and let them season, as a rule, for about three weeks under cover.

Drawing my conclusions from the above facts I should say :

1st—That water seasoning, either before or after sawing Simul, is not necessary.

2nd—That if water seasoning is done it should be done in the log.

3rd—That after Simul has been cut up into planks or shooks, 3 to 5 weeks in a covered drying shed is sufficient seasoning for all practical purposes, for the making of tea boxes.

4th—In dry, fine weather the drying and seasoning process can be greatly helped by standing the shooks on end in the open.

C. FORDYCE.

In the Darjeeling Terai, it used to be the custom for planters who used Simul wood, or other soft woods like *Anthocephalus* *Cadamba*, *Canarium bengalense*, and *Duabanga sonneratioides* to cut them up into planking immediately after felling, stack them on end for a while, and then make them up into boxes. In Dehra Dún there is too great a prejudice against Simul wood, to allow of its use, if it were to be regularly used it would be advisable to plant, for there are many areas of land which will not grow Sal, but which would grow Simul excellently. As regards the colour and quality of the wood, we believe that seasoning, either in water or not, is a mistake, as it has the effect of discolouring the wood. To keep it white, we believe, it ought to be cut up at once after felling.—*Hon.-Ed.*

Influence of Places on Spirits.

Have you ever experienced, on reaching certain places when on tour, a buoyancy of feelings, whilst on reaching others a depression comes over you. I ask this question because I think that the buoyance or depression arises from a variety of causes; and the experiences of many persons would provide interest, amusement, or sympathy, as the case may be. Of course, frequently, the causes of depression or buoyancy are palpable on the face of it; for instance a person has heard that a certain place is dead-alive, and he naturally is depressed in going there; the more so if he finds that his experience is that of his informant.

Again, previous experiences rather tend to bias one in favour or disfavour of a place; thus a person who has had some great mishap in a certain town, for instance, will generally, although he may have liked it well enough prior to the mishap, think it is unbearable after the occurrence.

Moreover, one's state of health is apt to imbue the locality with favourable or unfavourable feelings, as the case may be. Finally, the state of the weather is apt to influence. The combination of these influences, and many more, makes a marvellous variety of impressions, and there is invariably a liability to alter our opinions in regard to a place whenever these conditions are in any way changed.

For instance, a friend of mine heard that the Trossachs in Scotland was a lovely piece of scenery. He arrived there on a wet afternoon, and rather out of sorts; and thought that, at least, it was decidedly commonplace. He went there a second time in good spirits on a fine day, but expecting nothing out of the common, and found it as nearly perfect as could be seen.

Again consider the haunts of our youth, not visited from an early age until we have reached manhood. Lakes dwindle into ponds, palaces into petty country houses, and so on. But what I specially refer to are cases where there are no especial reason for buoyancy or despondency. I have been out but 6 days from headquarters, and on two occasions I have felt a feeling of buoyancy on arriving at certain camps, whilst at another I have felt decided depression. The depressing place I have been to upwards of twenty times, and always felt the same feeling more or less. The first time I went there I had received a glowing account from a late official in the district, after whom one of the suburbs was called. But before arriving there I experienced a horror at reaching it. My horror on that occasion were fairly justified. We—that is, wife, two children and self—arrived the other side of the rapid large river, that borders the town, just as the sun was setting. We had to be paddled across the raging torrent, for the river was very high, in a small over-crowded hand-paddle boat. We reached the opposite side, after sundry shipments of water, when it was dark, and we were then 2 miles from the dāk-bungalow, which had to be reached on foot over a desolate, sandy tract. On reaching the bungalow, no one was there; and when some one did arrive half an hour later, we learnt that the departmental boat had been taken off the day previously to the next district by the Conservator, and we should have to travel down in a native craft. However, our woes came to an end, the children slept, we had dinner, and at its close we learnt that the departmental boat had been returned by the Conservator. Moreover, the scenery from the river, especially at sunset, is beautiful. And yet everytime I go there I get this fit of depression on reaching it, although the congenial people I meet there speedily drive it away.

The first place on this tour, when I became so buoyant, I had never been to before, and knew nothing about. On inspection when the day broke, (I was travelling by canal), I found a medium sized native village completely surrounded by water, as the canal had overflowed, why then should I have been so joyous?

The next place I had passed before in my boat, but never stopped at. In my previous passages past it, it had certainly looked lugubrious enough, nor can I find, even after my fit of buoyancy, any real cause of joy for arriving there.

RAHDARI.

Forestry and Sylviculture.

The following is a reprint of the greater portion of a lecture given by Mr. D. E. Hutchins, Conservator of Forests, at Cape Town, on the 20th June, 1892 :—

In the Cape Colony and the Transkei we have about 550 square miles of high timber forest, and there is a larger area of scrub forest of which it is difficult to estimate the value or

even the area. We shall dismiss this in a few words. It will not pay either to conserve these scrub lands strictly, or to survey them accurately ; and in many localities they are of less value, either for forest or for grazing purposes, than would be open land of the same area. Of such is the Addo Bush, and the scrub lining the valley of the Fish River and other rivers on the eastern side of the Colony. The high timber forests of the Colony, leaving aside a small area of poor forest on the coast of the Alexandria Division, occur within the Colony in two localities, *i. e.*, at Knysna and the Amatolas. The Knysna forests stretch along the flanks of the Outeniqua mountains between George and Wit Els, near Storms River. The Amatola forests lie at a higher level and clothe, more or less continuously, the southern slopes of the Amatola mountains to the north of King William's Town, extending with the continuation of the mountains from near the Kei River to the Fort Beaufort division north of Grahamstown. Within these two groups of forest about four-fifths of the total area of forest still remained at the disposal of Government when the Forest Department was put on its present footing in 1883. Since that time there has practically been no further alienation of forest ; and the Knysna forests and the Eastern forests have been definitely constituted and set aside as a national trust. They have been placed in the charge of professional forest officers, and are now managed as are the forests of France and Germany. On this system the forests are being gradually improved instead of being destroyed, and no more is taken from the forests than the normal growth of the forests is calculated to yield. Mr. Theale in his able history of South Africa gives the popular view of forests in this country. Vol. I., page 182 :—

"All our indigenous, useful timber is of exceedingly slow growth, and the best is found in situations difficult of access. A South African forest is composed of a variety of trees mingled together, in which it rarely happens that half-a-dozen of one kind are found growing side by side. Gigantic creepers twine among them, and the spaces between the trunks are filled with tangled underwood and enormous ferns, so that one cannot proceed far without the aid of the axe.

"In such a forest the woodman fells a tree, which in its fall clears a large open space, where afterwards only a useless scrub springs up. To get the log out a pathway must be opened broad enough for a team of oxen to move in, and straight enough to prevent jamming. For this purpose a great number of smaller trees must be cut down, so that the quantity of wood contained in a wagon or the roof of a house represents but a very small percentage of the quantity deducted from the forest, and of that none is ever replaced. In this way the forests of Knysna and Tzitzikama, of the Winterberg and Amatolas are disappearing now just as those in the Cape Peninsula disappeared two hundred

years ago. They cannot be used and preserved too, as in countries where timber is of rapid growth, or as artificial forests, where waste can be avoided."

This quotation states in a few words the historical view of the subject. We foresters claim—and it is a claim that anyone can satisfy himself about by taking a walk through the forests—we claim to be using and at the same time improving the forests in our charge.

The forests at Knysna and along the Amatolas are managed on this system. The larger forests are divided up, and the small forests grouped together into a working unit called the "Series." In the Knysna Conservancy there are thirteen Series, with an average of about four thousand acres each. Each Series is divided into forty equal parts termed Sections, so that these Sections average about one hundred acres each.

One of the series in the Knysna Conservancy—that nearest George—has been so much overworked in the past that it has been entirely closed for the present. So that there are now open and being worked at Knysna twelve Sections, averaging a hundred acres each. Each year in each Series a fresh Section is opened. It will thus take forty years to work through each Series, and at the end of that time the Sections first opened for working in 1883 will again have mature wood grown up in them. When a forest Section is worked not all the trees are cut down but only those that are mature. Who is to judge what trees are mature? In this lies the pith of the whole matter. If you leave the judging to the wood-cutter, as in the old days, he will very naturally judge those trees mature which suit his own convenience. He will pick out the best trees and leave the worst to grow and form the forest of the future: he will overwork and destroy the accessible forest and leave mature timber to rot in the inaccessible forest. To avoid these evils, each forest Section, before being thrown open to the public, is thoroughly and closely examined by the Forest Department. Every tree in the Section is inspected, and those which, *looking at the future of the forest*, should now be felled are numbered, measured, and entered in a book kept for the purpose. This is a long and tedious business, and occupies the Conservator and Foresters for several months. We are always glad when it is over. It is pleasant to walk through a marked Section. At about every hundred yards (the distance depends on the density of the forest) lines termed virées have been cut to guide the workers. As one walks down these lines, or along an old slip-path, or occasionally along an elephant-path, the trees marked for felling come into view. Each of these trees carries a large cross in red paint high on its trunk; at its foot half-buried in fern and beautiful foliage is a number also in paint, and below all, probably on a gnarled root, is the Government stamp. With a little practice you will be able to see why each tree marked for felling has been selected. Here is

a hoary old giant of several centuries' growth. His massive limbs were flung out very much as they now are when the white man first came to the country ; his bole runs up straight and cylindrical for forty or fifty feet like the columns in the aisle of a Cathedral. No one cared to tackle him under the free selection system. He may be still good timber, or he may be a mere shell and too rotten already to work with profit. It is easy to see why *he* has been marked for felling ! By his side perhaps stands a slender stripling. We wonder why *this* has been marked for felling. Surely it will be worth much more in forty years. But it bears the fatal red cross ; and we look again. There on the other side of the trunk is a black streak ; higher up a decayed branch. That tree is rotten at the heart. It must be cut down to make room for a sound tree. Whatever value it has is in the present. In marking the trees for felling in a forest Section this is the principle followed :—*Unless there are cultural reasons to the contrary every tree is marked for the axe that will not in forty years increase in value more than its present value put out at interest at four per cent.*

Before a tree is marked for felling one has to look on the ground and look around to see what there is to replace it. No forester, if he can help it, makes a large gap in the forest. A gap in the forest is a dangerous thing. It lets in wind and sun. Wind may blow down the surrounding trees ; sun is more to be feared—it deteriorates the forest soil, induces a growth of grass and inflammable herbage. A sudden exposure to sun will kill the seedlings of forest trees. Stinkwood is especially tender in this respect. So you see that when a Forester plods down the virée lines day after day, marking the trees that are to be felled next year, he has plenty to think about, plenty to do ; and when each year's Section of forest has been completely examined, the most arduous part of his duties for that year is over. His work is checked by his superior officer, the Conservator, who, book in hand, checks 10 per cent. of all of his measurements, and criticises his selection of trees for felling.

Everything being now ready the forest Sections are thrown open to the public on the 1st of March in each year. The forest remains open for felling till the following June. All timber has to be worked and got out of the forest by the end of December : 15,000 trees on an average are thus felled yearly in the Knysna Conservancy. The average size of the timber from these trees varies according to the quality of the forest. In the Gouna forest near the port of Knysna, where it is almost virgin forest, the average of the trees felled is 56 cubic-feet each. In the poor forests near George and Plattenberg Bay, in forest that has been over-worked and irregularly worked for fifty years, this figure falls from 56 cubic-feet per tree to only 12 cubic-feet, and as low as 8 cubic-feet at Wit Els, the end of the forest country towards Humansdorp.

Each Section remains open for two or three years. It is then put in order by the Forest Department and closed for 40 years. Planting and thinning, more or less, according to circumstances, are required to put a Section in order. As a rule planting is only required at Knysna in case of accidents, such as forest fires. If all goes well, no planting is required. Thinning is always necessary. The thinning done at Knysna is called "improvement thinning." Its object is *not* to decrease the number of stems per acre, but to favour the more valuable species. The value of the different woods in the Knysna forest varies much. There are a number of woods that are practically valueless. There is one wood that sells at 1s. per cubic foot as it stands in the forest, a wood for which there is an unlimited demand, and a wood that we might send all over the world if we only had enough of it. I refer of course to Stinkwood. By improvement thinnings we can produce Stinkwood trees at a cost of about three farthings per tree. This is the way it is done: the Forester goes over the forest with three or four wood-cutters and wherever he finds young Stinkwood seedlings dominated by inferior species he fells or rings the latter, and sets free to the young Stinkwood trees. Only those who are familiar with the social economy of a close forest can appreciate the force of this operation. Charles Darwin in his masterly way describes the struggle in a close forest: in the animal world the struggle is mainly for food; the fittest survive. In the forest world struggle is for light. When we ring or kill an inferior species in the forest and so let in the light upon a dominated Stinkwood seedling, the practical effect is that a Stinkwood tree is produced. As I mentioned above, the average cost of this work is about three farthings per tree produced, so that it is more remunerative than any planting. It is also more certain since a tree is produced with the surroundings and on the spot where nature has placed it for thousands upon thousands of years back into the dim distance of geological time! It would take up too much space were I to attempt to describe severally the beautiful woods in our forests. I may just mention that Stinkwood is the valuable tree of the Knysna forests, and Sneezewood of the Eastern forests. In the Transkei both of the woods are found. In the Colony Stinkwood is found only to any extent in the Knysna forests, and Sneezewood only in the Eastern forests. The two species of Yellowwood constitute about 50 per cent. of all the timber in the forests. The two wagonwoods—Assegai and White-pear—occur throughout the Colony and the Transkei; but they are never abundant, and would in course of time become extinct, but for the cultural operations now undertaken in their favour. Ironwood is everywhere superabundant. It is hard to find outlets for it. It is a very beautiful but very hard wood. For general planting purposes our indigenous forest trees have not much practical value. They are all slow-growing,

and do not thrive away from the damp equable climate of the coast and the mountain ranges facing the sea.

Before quitting the Knysna forests, I must say something about the sleeper industry of Knysna. In most respects this is the most successful of all Colonial industries. It was begun in 1884, and during the last four years, one hundred thousand sleepers have been turned out yearly at an average cost of 5s. 5d. per sleeper. The average cost of the sleeper imported from England has been 5s. 6d., or *one penny dearer*. Wood is worked at Knysna under difficulties, especially in the matter of roads and transport that do not exist in Europe, so that in producing in the Colony a sleeper cheaper than can be imported, the result achieved is one that we may well be proud of. And this is not all. The Colonial sleeper is not only cheaper than the imported sleeper, but it is a better sleeper. It is harder, and so resists wear better. As to its durability, we have the best possible guarantee since we creosote it ourselves at Knysna. In the imported sleeper we have no such guarantee, and I am sure I shall betray no confidences when I tell you that many imported sleepers have come to this country with only a layer of creosote on the outside. They have been put on to the Railway, and I have seen them taken out still sound on the outside but rotten inside. Such a sleeper besides being a fraudulent article is dangerous to lay a line on. A formal promise has been given that no more wooden sleepers shall be imported. Some people will tell you that the days of wooden sleepers are numbered. I do not think so; and I am in a position just now to speak with some degree of confidence on this subject. The summer before last I made a tour through Germany, Switzerland, Holland, Belgium, and parts of Austria and France with the express purpose of renewing my acquaintance with the forests and of studying the sleepers used on the various lines of railways. I found that iron sleepers were making their way very slowly. In Switzerland and some of the German States, one-fourth of the total extent of railways was laid with iron sleepers, but this was the highest proportion. There are objections to the use of iron sleepers which have not yet been overcome, and probably never will be. The iron pot sleeper is clumsy and is used less now than it was 20 years ago. Various patterns of bent sheet iron sleepers are now being tried, but these are all much more expensive than wooden sleepers, they do not give such a good permanent way, and their exact durability, as compared with wooden sleepers, remain to be tested. I have seen the rust coming off some of them in thick scales. Until a galvanised sheet iron sleeper can be produced at a moderate cost, I believe that wooden sleepers will always hold their own. The great railway companies in England, with the finest railways in the world in their charge, will have nothing to do with metal sleepers. Our Colonial railways are, however, more like those on the Continent of Europe, and it is to these we must

look for guidance in the matter. They, as I have mentioned, are adopting iron sleepers very slowly ; and I cannot but think that we should do well to imitate their caution, and not, as at present, use only iron sleepers for the new railways in the interior, and for renewals on Colonial railways a short distance away from the coast. In the Karoo, iron sleepers are of course at their best, but in damp, warm climates they rust very rapidly. For our forests, the sleeper question is one of very great importance. Sleeper wood and other woods grow side by side in the forests. As long as the sleeper woods are utilised, the forests are worked at a profit. If we have to leave the sleeper woods to rot as was the case before 1884, it is so much loss to the forest revenue, and to the public who are the owners of the forests. Even more important than this is the money spent in the Colony instead of being sent away to pay for imported sleepers. Every year that the normal supply of 100,000 sleepers is taken from Knysna £24,000 are spent on Colonial wood and Colonial labour. And lastly, there is this point about the sleeper industry, the *labour is nearly all white labour*. I do not think there is any other Colonial industry quite in the same position in this respect.

Sleepers as yet are not produced from the Amatola forests, although there they could be produced cheaper than from Knysna, since the railway passes through the end of the Amatola Mountains, and on to the Port of East London where the creosote could be landed.

In the description of trees growing in them the Amatola forests differ little from the Knysna forests. As I have mentioned, imperishable Sneezewood replaces the valuable Stinkwood ; and, as always happens, the variety of species increases. This is not usually an advantage. The Eastern forests are managed on the same general system as the Knysna forests. Natural reproduction is not so good as in the Knysna forests, and more is spent on plantations. Where the railway passes through the Eastern end of the Amatola Mountains, at Fort Grey, there is a very extensive and flourishing group of plantations. These plantations being on the line of railway are very favourably situated for taking wood up to the treeless country to the north. The demarcation of the Eastern forests fell to my lot in 1883. We had a difficult, and to some extent, a dangerous task. The memories of the last Kafir War were still fresh. The Fingoes and Kafirs had patched up their difference, but no one felt quite sure how long this would last. For the time being, both were cultivating the arts of peace, which, as regards the forest, was very rapid destruction. Mealie gardens were eating into the forest in every direction. Frequently several forest fires could be seen at one time, all proceeding from the same cause, the felling of the forest for native gardens. I knew exactly what was required. I had ten years' experience of this sort of thing in India. We pitched our tents and got to work in a few days. We laid out our lines of demarcation, erected

our beacons, and mapped out permanent boundaries for the forests. For the first year or so little opposition was shown. Then the "native mind" became aroused. There is something mysterious and awe-inspiring about this phrase "the native mind." More is usually known about it at Cape Town than on the frontier. It is an intangible and immeasurable quantity. No man may tell its exact height, breadth, and depth. But in 1885 we felt its power. For some time it looked as if our work, and with it the forests, would be abandoned to destruction. Then better counsels prevailed. A Government Commission was appointed which, after long and close enquiry on the spot, practically confirmed all we had done. Our demarcation lines remained, and the forests were saved! The forests now had definite boundaries, and as soon as a man and an axe crossed these boundaries he had to justify himself before the magistrate. Then arose another difficulty. Here were forests, forest officers and magistrates, a plentiful crop of forest offences—but no forest laws. Many of our magistrates are negro-philists and in their hands forest protection on the frontier was little more than an expensive farce. This was remedied by the Forest Act of 1888.

In the Transkei, Forestry is beset with many difficulties. Considering the state of the country good progress is being made in demarcating and conserving the forests. That an efficient check is now being placed on the fearful forest destruction that prevailed there a few years ago is shown by the long yearly roll of successful forest cases.

[At this point of the lecture large polished specimens of all the valuable Colonial woods were shown, one by one, and descriptions given of the trees that produced them]

I shall now throw on the screen some views of Colonial forest trees taken in the forest under my supervision.

No. 1.—A Yellow wood tree. It does not look so big in the picture as it is in reality.

No. 2.—Red Els, growing on top of a mountain on bare rock. It is quite certain if that tree were not growing there, nothing else would.

No. 3.—Wild Lemon tree.

No. 4.—Tree from gorge, Pirie forest.

No. 5.—An overworked forest, ripe for fire—portion of Pirie forest.

No. 6.—Sneezewood and Kafir-plum trees, Perie.

There is one general feature running through all the views—the smallness of the bulk of wood per acre.

In this matter our forests are inferior to those of Europe. It is a failing that will decrease with the regularization of the forest now taking place, and the replanting of burnt forest. I should have mentioned that last year at Knysna rather more than 12 young trees were planted, mostly in burnt forest, for each tree felled.

In our indigenous forests, small though they are compared with the forests of other countries, we have a valuable possession. Unfortunately there is practically no indigenous forest near Cape Town, nor even in the west of the Colony nearer than Knysna, so that the tendency has been to neglect the indigenous forests in favour of plantations. Out of sight has too often been of mind. Then, too, from an administrative point of view, there has been the trouble with the local population living in and near the forests. These people gradually get to look on the forests as theirs—it is the same story everywhere—and to resent the necessary restraints required for the preservation of the forests. And thus it has come to pass that, relatively, too much attention has been paid to plantations, and too little to our grand, natural forests. We see and enjoy the one, the other is hundreds of miles away. The tree at our doors looks larger than a square mile of forest on the frontier!

But, if we put the matter to the test of figures, we see that our best plantations are mere child's play compared to the natural forests. If the 550 square miles of natural forest in the Colony and the Transkei were to be allowed to be destroyed, to replace them on the basis of present cost of plantations would require the enormous sum of nine million pounds sterling. Any such expenditure is of course entirely out of the question. The natural forest must either be preserved by careful and systematic management, as at present, or else inevitably lost to the country for ever. How easily the natural forest may in a few years be totally destroyed, we see in the history of the Katberg forest and the forest near George. The first was managed by Government, the second by the Municipality of George. In both, the felling was done under supervision and with the best intentions for the preservation of the forest. In both, east and west, the result was the same—final destruction by fire. The management of the evergreen forest of warm temperate zones is by no means an easy task. An amateur had much better try his hand at building a five-storey house or a modern ironclad!

A cause which has operated against forest conservancy in the Colony has been the prevalence of English ideas, and as English ideas have had, and will have, so much influence on forest conservancy in this Colony, I must say a few words on Forestry in England.

Forestry, as it is understood in France and Germany, is unknown in England. The average Englishman may be said to know about as much of forestry as a Chinaman of electricity. And the worst part of the matter is that he does not want to know anything about it. He wraps himself up in some trite free-trade maxims, remarks that land is valuable in England, and that it is cheaper to import timber from abroad. But now what are the facts? The beautiful forests of oak, beech and Scotch pine that once covered the greater part of Great Britain and Ireland are gone. Miserable mismanaged remnants exist in a few localities, but for all practical purposes

the ancient forests of the two islands have ceased to exist. So completely have they disappeared that in the cases of some of the most famous old forests, antiquaries cannot now say for certain in what counties even they were situated. Since the time of William the Conqueror, forestry in England is one long sad story of ignorance, apathy and neglect. Barren mountains, dreary heaths, and profitless bogs occupy the waste land, and the tourist in search of the picturesque hurries across the channel whenever he can snatch a few days leisure. Now let us see what England pays for this waste of its resources. The tourists rush away from the desecrated land like rats from a sinking ship. Tourists spend a good deal, but the loss of their money is a mere flea-bite. For imported wood England now pays every year the enormous sum of fifteen million pounds sterling. During 1891 six and three quarter million loads of timber, valued at fourteen-and-a-half million pounds sterling, were imported. Sir Herbert Maxwell, in an article in the *19th Century*, tells us that a further sum of fourteen million pounds is paid annually for forest products, such as bark, turpentine, resin, nuts, &c. I have no details of these figures, and so shall say no more about them, but the fifteen million pounds paid yearly for imported wood has been discussed by Dr. Schlich (the Principal Professor of Forestry at Cooper's Hill), in a paper read in March, 1890, before the Royal Colonial Institute. I have also had the advantage of talking the matter over with Dr. Schlich, and this is what he says:—Of the fifteen million pounds sterling paid yearly for wood imported into England, about three millions is for tropical hard woods that cannot be grown in England. The remainder, that is to say twelve million pounds sterling, is for wood that could be grown equally well in England; and further, Dr. Schlich reckons that if the waste land of Great Britain and Ireland were under forest this quantity of wood would be produced four times over. So that twelve million pounds sterling are now paid yearly by English simply as the penalty for the blind neglect of its forest resources in the past.

To my mind the saddest part of the whole story is this: The twelve million pounds sterling that is paid to Russia, Sweden, France, Germany and North America has to be met somehow, and it is paid in manufactured goods, goods that are produced by the labour of the factory operative, that physically degraded type of humanity one sees in all big manufacturing towns. With the destruction of the forests in England have gone the stalwart men who once worked in them, to be replaced by the factory hand—weak-lunged, knock-kneed and sallow. One has only to travel through the forests of the continent and then visit a few of the large manufacturing towns of England to have this physical degradation of the race brought home in the most forcible and unpleasant manner. Dr. Schlich estimates that one million people live directly on the forests in Germany, and three million people on forest industries, the first earning in wages about eight million pounds and the

latter about thirty million pounds sterling. But let us consider the one million people that live and labour in the forests. What a reserve of national strength ! They are fairly, most people would say sufficiently, educated ; and their healthy life in the open air and constant exercise preserves a physical development, a strength of frame, sinew and constitution that is rare in these days of machinery and easy chairs. Judging from what I saw at a recent visit to the forests of Germany and the big towns of England, I should say that England could better afford to pay twelve million pounds sterling a year to make good her wasted forest resources than to lose the broad-shouldered and muscular men who once worked in her forests. These are the men whom we value as colonists—men fitted to form the backbone of nations.

A very interesting table is given at page 54 of Dr. Schlich's Manual of Forestry. There he shows that in the matter of forests England stands below all the civilised nations of the world. In Germany 26 per cent., or just over a quarter of the whole country is forest. Great Britain and Ireland follow after Portugal in the list with 4 per cent. of woodlands. Even this wretched 4 per cent. is not forest but parks and scattered ill-managed plantations, producing timber inferior to forest timber. Country gentlemen will tell you that plantations do not pay, and I am sure I am not surprised at it. The year before last I spent several days in rambling over the historical New Forest in Hampshire. It represents about 100 square miles (nearly the area of the Knysna Forest) in the heart of fertile England, condemned to perpetual sterility by Act of Parliament. The situation is very well put in the article I have mentioned already, by Sir Herbert Maxwell. It would be ludicrous if it were not so sad !

When the home-staying Englishman talks to you about forests and free-trade heed him not. England is rich and strong, but can she long stand this drain—*twelve millions sterling paid yearly to the foreigners for wood that would be better grown at home, and her strongest men turned into hysterical factory hands ?*

The wealth and strength that Germany draws from its forests are astounding. Travelling through southern Germany from east to west, one is never out of sight of forest ; at one time surrounding us with the breath of its poetry and beauty touching us ; at another clothing with wealth otherwise barren ranges of mountains. One traverses villages where the inhabitants have their firewood and fodder free, their rates and taxes paid for them, their school and libraries built, out of the revenue drawn from the village forests. This is an important point to remember. In France, Germany and Switzerland (two of these States, Republics) the communal forests belonging to villages are managed by Government forest officers, and the proceeds handed over to the villages. Taking Germany and Austria together there is a trifle over one acre of forest per head of population. Though the forests of

Germany, France and Switzerland have been managed on the present system for one, two and sometimes three centuries, there has been a steady increase in the quality of the timber during the last half century.

The dwellers in climates warmer than Germany derive an additional advantage from their forests in the improvement of the climate and the increase of the water supply. A long series of carefully conducted experiments has shown that forests do materially modify climate. (1) They render it several degrees cooler. (2) They render it less brusque, *i. e.*, less subject to extremes. (3) They slightly increase the rainfall. (4) They largely increase the yield of springs. These are benefits in which countries, situated as is Cape Colony, participate to the fullest extent.

Comparing Colonial forests with the forests of Europe and North America it will be seen that we are at a disadvantage on the following points:—

(1) Absence of pines—It is calculated that 9-10ths of all the wood used in the civilized world is pine wood. Pine wood with its tissue more or less full of turpentine and resin has a distinct advantage over the empty tissue of yellowwood. It is this emptiness of tissue that, more than anything else, renders yellowwood so liable to warp.

(2) Superabundance of useless hard woods, specially Ironwood.

(3) Want of access to forests.—It is only two years since purely forest roads have been made at Knysna. These roads cost from £60 to £80 per mile, and usually pay the total cost of construction in the wood brought over them in one or two seasons. The waste in working wood without roads at Knysna has been almost incredible. How such a state of things could have lasted so long is most extraordinary, considering the forest roads in Germany.

When all is said, the main difficulty in the way of the more extended utilisation of the Knysna forests lies in the difficulties of transport. To these difficulties of transport on land are added excessive charges for sea transport. It costs (within two or three half crowns per ton) as much to bring wood from Knysna to Cape Town as from Europe to Cape Town.

The extension of our forest resources opens up an almost boundless field of usefulness; it will slightly improve the climate; it will largely increase the water supply; it will afford profitable employment for a large number of people—employment that will keep the people in the country and on the soil as in Germany, France and Switzerland, and not force them into the big towns as in England and Australia. Lastly, our forests are a very solid slice of national wealth. They are now being regularised and improved on the German system, extended by plantations and opened up by roads. Last year the Forest Department at Knysna planted at the rate of twelve trees for every tree cut down, and made two forest roads. The revenue from the Knysna

forests has doubled during the last five years ; and is now sufficient to cover all ordinary expenditure. It will not be the fault of the Forest Department if there is not soon a handsome surplus. The Colony now pays on an average £100,000 yearly for imported wood.

II.—CORRESPONDENCE.

Water Areas in Reserved Forest.

DEAR SIR,

When I see legal questions asked in the *Forester*, I have observed that you are glad to have an answer from me, even though the space and time for transit that separate us are so considerable. Moreover, I feel that if others have already sent you an answer, you have always the option of omitting mine; and besides, it may sometimes be useful to have two independent opinions. I proceed therefore to reply to the query in your No. for July 1894, page 259 :—

It will be observed, that the conditions of Indian life, unlike those of Europe, necessitated our opening the Forest Act, with a provision for constituting the 'Forests' or areas which were to be subject to Forest Law. In Europe, these areas already were known and existing. Accordingly, the third Section of the Act of 1878 speaks of *land* in which Government has rights, &c., that would hardly justify us in taking up a lake *merely as such*, or an extent of river, or tidal water without reference to the Forest on either side. In the nature of things such a course could hardly be necessary. But if the water were not merely an area of water by itself, but could be regarded as part of an area of land, or as a natural feature of the land, which Government required to treat as forest, then, there is no doubt, that the lake, river, tidal water, &c. included in the boundary, would be part of the forest area, and subject to the Forest Law; if any rights to use water, to fish, etc., were claimed, they would be enquired into and settled under Chap. II*. This is obvious from the terms of Sec. 25, which refer to 'fishing,' 'poisoning water' and to rules made on the subject; such a provision could not be effective unless the enclosed river, lake, etc., were part of the forest and subject to the Forest Law.

I do not know what is meant by a "public right of way" to lake B situated in a reserved forest. If there were a public road leading to the lake, it would necessarily imply some right in the public to use the water of the lake in some way, and such a right

* Sec. 10 does not mention rights to 'use water,' but practically such rights (often of great importance) have been held to be included (cf. Sec. 12 Burma Act.)

should be defined and provided for by the settled arrangements of the Forest. And so, if a private right of way existed to the lake, it would, of necessity, imply that there was some right of using the lake, otherwise why is there a right of way to it?

It will be remembered that Government has a general right to the use and control (for public purposes) of all rivers, streams and lakes and 'natural collections' of water (Act VIII of 1873). This applies to Northern India and the Central Provinces, but there are similar laws elsewhere (see, for example, Bombay Act VII, of 1879, & especially Sec. 37 of the Bombay Land Revenue Code.)

There can be no sort of doubt that a person, who had no right defined and recorded under Chap. II, to use water, or to fish inside a reserved forest and proceeding to do so, would be guilty of a civil trespass, and could be ejected, and further, if having no such right, his fishing, &c., were in contravention of rules (Sec. 25 *i*.) he would be liable to criminal prosecution. Sec 31, (*j*) makes the same principle applicable to the so-called "Protected Forest," only that there is the same doubt about rights that there is in every case owing to the general imperfection of the procedure regarding the class of Forest.

Oxford,
August, 1894. }

B. H. B-P.

P. S.—I do not know whether 'fish' are intended to be included in "wild animals" of the definition of "Forest Produce" (*b. iii*), probably they are, but the matter is unimportant, as rules may regulate or prohibit "fishing" in any case.

A Cure for Snake-bite.

SIR,

In the article on "Cure for Snake-bite" in the August issue of the *Indian Forester* there appears to be nothing new in the remedy recommended. The usual method of obtaining ammonia is by treating any ammoniacal salt by a fixed alkali. A sulphate or hydrochlorate of ammonia is generally heated in a retort with lime, ammonia being given off, and sulphate of lime or chloride of calcium being left in the retort. Similar results may be obtained with chloride of ammonium (sal ammoniac) and "chunam." The strength of the solution of ammonia would depend on the operator. The first symptom of ammonia poisoning are irritation and constriction of the throat, which always resulted in Mr. Twining's practice. We may therefore conclude that Mr. Twining's specific was simply a strong solution of ammonia, and that he first recovered the patient from partial or total collapse by the aid of a strong stimulant; and then, the stomach being able to work, induced vomiting by repeated weaker doses of the same medicine. It is improbable that vomiting would have any beneficial effect on the patient; but served as a visible proof that he had received as

much stimulant as he could hold. If the act of vomiting was necessary to the cure, other more powerful nauseates could be used. Probably Mr. Twining would have been more successful if he had stopped short of inducing vomiting, allowing his patient to retain the stimulant. As to the "internal slaking" of quicklime that had already been completed in the retort, that is to say, if quicklime was foolishly used, it would probably be as easy for most people to swallow the cobra as to swallow quicklime, and the ultimate result would be the same in both cases.

O. S.

White-ants and Mr. Cotes' Manual.

DEAR SIR,

I have just come into possession of the Manual of Zoology, prepared by Mr. Cotes for the use of Forest Officers in India. I find Mr. Cotes classes the white ants (*Termitidæ*) and dragonflies (*Libellulidæ*) in the Orthoptera. No doubt he has good reason or good authority for doing so, but to me that given in the Manual, viz., that, like the Orthoptera, they have no pupal stage of rest, seems inadequate. The wing characters, which in these two groups are exactly those of the Neuroptera, seem to me far important.

With your permission, I propose to add here a few remarks on the life history of the *Termitidæ* to the account of them given by Mr. Cotes, in the hope that I may induce some of your readers to make a study of these curious insects.

It is the general, indeed as far as I know the invariable, rule among the Insecta that a female once fecundated is fertile for life, whether that life be one of hours as with the butterflies, or of years as with the social bees and the ants. Amongst white ants this is not so, the male and female live together as husband and wife all their lives. Mr. Cotes mentions a class of the community, besides the "female or queen," which he calls "winged males and females" "which fly out of the nest in clouds, generally after 'rain.'" The name used is not absolutely scientifically correct, for these are not males and females, but *potential* males and females, in the sense that their sexual organs are not developed. They pair, it is true, but the marriage is not consummated until 10 days or a fortnight later, during which interval the female, always closely followed by the male, has selected and taken possession of the site for the new nest (either in or outside the old nest). This unique (?) system of betrothal is apparently a provision against the chance of adulterous unions (which, as I have shown above, are possible only among the Termites), for the unattached bachelors who formed a large proportion of the original "swarm" have all been cleared off by lizards, birds, &c., long before the date of the actual consummation of marriage between the paired couples. The danger would, however, again arise as soon as new males were

born and adopted into the nest with their wives. In a species whose nests I examined in South Africa, I found that the first work of the first generation of workers was to wall up their father and mother in a clay shell rather larger than a walnut, with only one small opening, too small to admit any but a worker. Do the Indian white ants do this, or anything analogous? Every one must have been struck with the parallelism between the social organization of the Termites and the ants, especially in the neuters (?) or workers. But there is a fundamental difference, for among the social bees and wasps and the ants the workers are all aborted females, while the worker white ants are as often aborted males as aborted females. Can this be connected in any way with the half developed males mentioned above? For a thoughtful observer there is a most interesting field of enquiry open among the Termites.

R. C. W.

The strongest timber.

DEAR SIR,

In the *Indian Forester* you ask for information about the iron-wood called 'Bilian' coming from Borneo.

In the Dutch periodical "Natuurkundig Tydschrift van Nederl. Indië," Vol. 25, pp. 1 to 6, the following information is given regarding the *Eusideroxylon Zwageri* by Messrs. Teysmann and Binnendyk. "It is common in Borneo, in the coast regions, 'not in marshy places but rather above the line of the highest 'rise of river inundation. It is known locally by the names 'Belian', 'Blian', 'Boelian', 'Toelian' and 'Oelin.' In Bangka and in Sumatra (Palembang) it is called 'Onglin' or 'Balian.' The wood is as durable as iron, or even perhaps more so. Posts which have for 20 years or more stood the influence of rain and wind, seem now almost as fresh and strong as when the wood was freshly felled. In a short while, Indian Forestry will have some information on the subject, for the Dutch Government has, since May last, had a commission consisting of an Oberförster, two assistants and natives arranging for the exploitation of the 'Onglin' forests of the province of Palembang in Sumatra.

S. H. KOORDERS.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Imperial Forest School Report, 1892-93.

The following is the Resolution of the Government of India on the Forest School Report, 1892-93. We have no information on the subject, but we presume that the Government of India has been trying to persuade the Government of Bombay to utilize the Institution like the Government of Madras. We believe that the Bombay Forest Officers are mostly, if not all, in favour of the arrangement which, of course, could only tend to improve the general esprit de corps, and that it is some sort of jealousy which prevents the Governor of Bombay and his advisers from acceding to the wishes of the Government of India :—

“Orders on the Administration Report of the Imperial Forest School for the period of fifteen months ending 30th June, 1893, were deferred pending consideration of proposals, which have now been negatived, for the utilization of the Institution in the scientific training of the subordinate forest establishment of the Bombay Presidency. During the period under review, a complete set of rules for the constitution of, admission to, and discipline at the college were issued with the Resolution of this Department. No. 11-F., dated 28th June, 1893. These rules were prepared by the School Board of Control, and submitted at the close of the period under notice, during which the school was successfully administered under previous regulations and practice. In these circumstances the work of the year and the results achieved, which reflect credit on the school officers, call for no further observations or orders.”

Allowances of Working Plans Officers.

The following new rule regarding the grant of allowances to Working Plans Officers has been published :—

“The Local Government may, when a working-plan has been approved and accepted, sanction to any officer who may have been in charge of such plan, a remuneration which shall not exceed Rs. 100 per mensem for the time during which he has been at work on such plan ; provided that no remuneration shall be granted unless the Local Government is satisfied that the officer has undergone exceptional exposure or incurred exceptional expense. This rule shall apply to both specially appointed Working-Plans Officers and Divisional Forest Officers in charge of working-plans.

“The rate of remuneration shall be fixed with regard to the importance and character of each plan, the labour and exposure entailed in its preparation, and the proportion of the officer's time occupied in its elaboration. The limit of Rs. 100 per mensem shall not be exceeded in consequence of an officer being employed on two or more plans at the same time.

“When two or more officers have been in charge of the same plan or plans, the remuneration granted should be divided in proportion to the time that each officer was in charge, subject to the consideration of the quality of the work and the labour entailed in each case.”

IV.—REVIEWS.

Annual Forest Administration Reports, for 1892-93, for Bombay and Burma.

The chief event of the year in Bombay was the formation of a new Circle by sub-dividing the old Northern Circle, so that there are now four Circles in Bombay: Northern, Central, Southern and Sind. To the great disappointment, however, of Bombay officers, there is a decrease rather than an increase in Conservatorships, for two of the appointments, at present, the Northern and Sind, are to be held only by Senior Deputy Conservators. To have started a sense of disappointment and injustice for the sake of Rs. 400 a month was hardly worth while, for the money might easily have been saved in some other way.

The Circles as now divided comprise the following districts—

N. Circle—Thana, Surat and Panch Mahals.

C. „ Khandesh, Nasik, Ahmednagar, Poona, Satara, Sholapur.

S. „ Kanara, Belgaum, Dharwar, Bijapur, Kolaba, Ratnagiri.

So that it would seem that the contention of the Southern Circle Conservator that the two Concan districts of his charge ought to be transferred to the Northern Circle, or the whole arrangement altered, has reason for support.

Mr. Dasai's report on the new Northern Circle is an interesting one, and contains many points worthy of note, and among them the following remarks by the Collector of Thana regarding the high percentage of acquittals in his District:—

“I review nearly all forest convictions myself, and I think the falling off in percentage of convictions to be rather due to greater care on the part of the Magistrates (formerly very lax in matter of evidence in forest cases) and to the personal equation of one or two Magistrates than to any difference in the departmental methods of prosecutions.”

We wonder if he took any steps to make the latter set of Magistrates understand that justice, and not personal bias, was what was required when cases had to be tried, forest or any; and whether he had any idea how extremely difficult it is for a Forest officer to obtain full evidence, even in cases where there can be no practical doubt of the matter.

In the Central Circle Report, too, there are some remarks on the question of forest prosecutions, which are of interest:—

“The cases prosecuted in the course of the first twelve months of the forest year in the Satara Division exceeded by 37, the number of the year before, and the percentage of failures shows a slight increase. The Divisional Forest Officer complains that some of the Subordinate Magistrates deal out very lenient law to the offenders, and dismiss them on the grounds that “the offences were not intentionally committed, and the accused had no intention of setting the forest on fire when he was smoking in the forest, and therefore is not guilty ;” and in cases in which men of position, such as patils, &c., are accused, they are dismissed, on the plea that they are not the sort of men to trespass cattle. It is no wonder, then, that cases which are fully scrutinized by the Divisional Forest Officer before they are sent for trial, should go to increase the percentage of failures, for the Forest Act does not recognize intention, and the Divisional Forest Officer in his treatment of forest offences is guided by the Forest Act, while the Subordinate Magistrates ignore the forest law on the point, and require “intention” to be proved.”

Again, in Sind, the question of prosecutions is discussed, and an example is given where a Divisional Officer, who seems to have taken too literally the remarks made last year by the Commissioner, got duly snubbed for his pains :—

“The Deputy Conservator regrets to report that the remarks made by the Commissioner in Sind in para. 6 of his review of last year’s report have been misunderstood, and have caused Divisional Forest Officers to refrain from instituting proceedings, where proceedings were necessary. In one instance a Divisional Forest Officer refused to prosecute in a case, and when called upon for an explanation, wrote : “I have no desire to be harsh in administering the law, and I hoped it would be understood that, in declining to prosecute in the case under reference, I was endeavouring to carry out the Commissioner’s wishes.” This, of course, could not be allowed, and the Deputy Conservator was compelled to write to the Divisional Forest Officer as follows : “I am afraid you are allowing the Commissioner’s remarks in para. 6 of his review of the last Administration Report to influence you more than they are intended to do as regards the prosecution for forest offences in your Division. The Commissioner never intended that serious forest offences should remain unpunished. He simply wished to caution forest officers against any undue severity, and to impress upon them the necessity of acting in a kindly and forbearing spirit to those living on the borders of the forests—nothing more. It is scarcely necessary for me to point out to you that should it become known that you decline to take action against offenders, offences will increase to the detriment of the forest, and the demoralisation of those serving under you. The disinclination you appear to manifest to support those of your subordinates who have actually been assaulted, will have a tendency either to prevent them, through fear, from doing their duty,

‘or it will cause them to combine with the people and take compensation from offenders for their own benefit. In the case referred to in the letter under reply you are requested to prosecute the offenders.’”

It is satisfactory to read the remarks of the Government on this subject, for they lay down their policy in a dignified and satisfactory manner :—

“The percentage of failures is higher in all the Circles than in the preceding year, and notably so in the case of the Northern Circle and Sind. The reasons given for this result are various. Different Magistrates hold different views as to the gravity of offences against Forest law, and as to the nature and amount of evidence sufficient to justify convictions in such cases. The result may be due, as Mr. Sinclair surmises in the case of Thana, to greater care on the part of Magistrates in weighing evidence rather than to any difference in departmental methods of procedure. There appears, however, to be on the whole a prevailing disposition on the part of the Magistracy to treat forest offences leniently. It is the policy of Government to prevent forest restrictions from becoming harassing so far as is possible with due regard to the paramount importance of preserving the sources of supply. Leniency in dealing with breaches of Forest law is proper in the case of first offences and petty and isolated pilfering for personal use. It may also be proper when restrictions necessitating sudden changes in the daily habits of the people have been recently introduced, and are imperfectly understood. But leniency is misplaced and destroys the deterrent effect of criminal prosecutions when forest depredations, however trivial they may appear when considered as individual isolated acts, have become in any locality, in spite of repeated warnings, systematic and persistent.”

Some of Mr. Dasai's remarks on natural reproduction are worth quoting especially those which relate to the result of the coppice cutting :—

“In the Thana forests natural reproduction was vigorous during the year and would be perfect if fires and cattle trespass could be wholly checked. The coppice in most of the exploited coupes grows fast, though the teak excels other species in this respect during the first years of its re-growth. The shoots also suffer to certain extent, when they first commence to appear, from the browsing of wild animals, such as nilgai and four-horned antelope ; the neighbourhood of a recently felled coupe being almost a certain find for one or other of these animals. In a good many of the compartments exploited in the earlier years of the Working Plan rotation, *i. e.*, in 1887-88, a dense crop of promising mixed forest is now to be seen, and the progress made by each year of successful closure in dominating the grass, reeds and other noxious growth has secured the compartments from all

‘possible danger from fires. So long as there is a sufficient area open to grazing for the wants of the people, it is not advisable to shorten the limit of closure of ten years fixed in the Working Plan, for the longer the young stock is left undisturbed the better it will grow.’

In other Divisions, fires have prevented natural reproduction to a considerable extent, but the following testimony of Mr. Lely, Collector of Surat, to the labours of the Department will be read with interest :—

“Some of the forests in the south of the district though small are pictures. In Mandvi Taluka the soil is inferior, but the Department is there reclothing large tracts of land and vindicating itself as one of the most useful agencies of the country.”

In the Central Circle report, too, there are some interesting remarks on natural reproduction :—

“The year under report was favourable to natural reproduction, owing to a plentiful and seasonable rainfall generally throughout the Central Circle. In the East Khandesh Division it was very refreshing to observe the myriads of young plants of teak and of other kinds of timber trees resulting from self-sown seeds which appeared in suitable soil, on the bank of the Aner river, and in fire-protected areas, in the Satpuda and other forests. The Anjan (*Hardwickia binata*), which does not seed annually or regularly, seeded during the year, and has given an abundant supply of young life in the Transpurna, the Raver, Savda, Yaval and other reserved forests where this valuable tree predominates. The stools of trees which were felled in the forests of the Jamner Range and in the Satpudas have thrown up vigorous shoots with scarcely any failures.”

There is nothing particular to be noted, on this subject, in the Southern Circle Report, but the Sind officers complain that the river bunds are seriously affecting reproduction. Mr. Hexton says :—

“There can be no doubt that the bunds prevent a vast amount of natural reproduction, and have rendered many of the once well-wooded areas quite useless for forest purposes. Take the country from Kashmor to Shewan on the right bank of the river, nearly the whole of this portion of Sind is cut off from the floods, the result being that the jungles are fast drying up, and unless some change takes place, there will soon be a scarcity of fuel even for domestic purposes.”

The following remarks from the Northern Circle Report are interesting, as drawing attention to a minor produce industry, of which little is known outside Bombay :—

“Of the two trees, ‘apta’ (*Bauhinia racemosa*) and ‘temb-burni’ (*Diospyros melanoxylon*), whose leaves are used as wrappers for cigarettes by the people generally, the latter has been so much damaged in the past during the process of plucking that it was considered desirable to put a stop altogether to the

‘farming of its leaves, and in order to further improve its growth, ‘mutilated specimens to be met within the coupes are no longer ‘to be reserved as standards, as was the practice in former years, ‘for the sake of its fruit. The tembhurni coppices fairly, and if ‘the injured and deformed trees are properly cut and trimmed, ‘and the leaves protected, it ought to yield good timber when it ‘reaches the exploitable age. The main utility of the apta trees ‘lies in its leaf, it being not valuable as timber. It is also very ‘hardy, stands a good deal of knocking about, and does not suffer ‘to the same extent as the tembhurni from harmful treatment ‘The demand for its leaves is already fairly large, and there is a ‘prospect of its increasing in proportion to the diminished supply ‘of tembhurni leaves, and, therefore, its exploitation has to be ‘restricted.’

We are rather doubtful as regards the policy of trying to grow ebony wood rather than to exploit the same for the local uses of its leaves. The best Indian ebony is that of the South Indian *Diospyros Ebenum*, a tree which is by no means common even in the dry Carnatic evergreen forests which it affects, and the wood of *Diospyros Melanoxydon* and *tomentosa*, the common ebony trees of South and North India, respectively, gives so little real ebony, even when the trees are large and sound, that it may be doubted whether it is worth while to try and encourage them for the growth of the fancy wood. It might, perhaps, be better policy to reserve both ‘apta’ and ‘tembhurni’ among the coppice standards in order to allow of their being pollarded yearly for their leaves. This subject further suggests to us the question whence comes the ebony which is quoted in the English market as ‘East Indian.’ There is not much of it produced, and sold in the Madras Presidency, perhaps the bulk comes after all from the Bombay coast forests!

Artificial reproduction works for the filling of blanks in the forests seem to be much more successful in Bombay than in other provincess. In the Northern Circle 3,640 mannds of seed were sown by Forest Guards in one Division alone, and very extensive works seem to have been carried out in the Central Circle. On the works done by forest guards, Mr. Shuttleworth says:—

“The cultural operations undertaken by forest guards, as a ‘part of their ordinary duties, cannot but have a marked effect ‘upon the re-wooding of the country within the Central Circle. ‘Each forest beat, (and all the forest areas in every division are ‘divided into beats, so that not an acre in charge of the Forest ‘Department is left outside a beat), is an unit of plantation; so ‘that reboisement is pushed on yearly in as many different localities ‘spread over the face of the country, as there are forest guards in ‘charge of forest-beats.”

And we can only feel envious, as we said last year (Vol. XIX, p. 393), for our own experience of forest guards in several provinces is that not only do they not attend to such work, but that they could not consistent with the protection and supervision of an

unwieldy area. We hope the day may soon come when the increasing yield of the forests will make it possible to reduce the size of beats, so that each guard will have scarcely more to look after than has a French 'Garde forestier,' and like him can do most of the planting, cleaning and similar work in his charge. The returns in form 56 for the four Circles give the following work done, taking additions only :—

REGULAR PLANTATIONS. | CULTURAL WORKS.

	Area	Cost	Area	Cost
	A.	Rs.	A.	Rs.
Northern ...	438	807	2,851	1,747
Central ...	2,144	4,383	95,427	9,827
Southern ...	41	848	10	557
Sind ...	...	2,155	6,505	...
	2,623	8,193	104,793	12,131

though we do out pretend to understand the figures.

The Review of the Forest Reports by the Bombay Government is noticeable for its much more conciliatory tone than usual, and for the way in which it gives full credit to the Conservators for their work during the year. We have not received the review of the Government of India, so we will conclude with the following extract from the 'Pioneer' of September 13th regarding it :—

"Remembering the friction that once existed in the Bombay Presidency between the Forest officers and the Executive, the comments of the Government of India on the local Forest Administration Report for 1892-93 are pleasant reading. The able and exhaustive review of the Governor in Council is acknowledged, and it is added that "the harmony and good feeling which mark the relations between Revenue and Forest officers, and the praise bestowed by His Excellency on officers in charge of forest circles, for the efficient manner in which they have discharged their duties, and on Revenue officers for the cordial assistance they have rendered, have been noted with satisfaction." We need not comment on this, beyond expressing the hope that the harmony thus established may endure, and that there is nothing behind the scenes likely to disturb it. As to the report itself, the figures show that only a small increase of Rs. 18,000 occurred in the net revenue from forests as compared with that of the previous year ;

‘but the surplus was nearly Rs. 95,000 above that of the quinquennial average. Bombay gets now about 13½ lakhs clear profit from its forests, and this sum is capable of expansion. A difficulty has arisen in Sind, where the growing demand for fuel has been checked by the restriction of the productive forest area owing to the exclusion of flood-water from the Indus. The Government of India consider this a grave question, but note with approval that the difficulty is being met by the constitution of reserves in alluvial lands outside the influence of protective dams. Even this, however, may not prove sufficient, and it is suggested that irrigated plantations may be found to be necessary. The subject is one in which experts should be consulted without delay.’

In reviewing the BURMA Reports, the Government of India say :—

“The chief administrative measures involving change were the division of Upper Burma into two circles; the promulgation of a revised edition of rules under the Upper Burma Forest Regulation, and their extension to parts of the country which had till then been exempted; the enhancement of the royalty on timber extracted for trade purposes in the upper portion of the province; and the inclusion of *kaungmhoo* (*Shorea stellata*) in the list of reserved trees.”

And they comment on the financial results as being the best on record. These were, for the whole Province :—

	Rs.	
Revenue Financial year	56,60,001	Forest year 54,73,058
Expenditure „	17,47,356	„ „ 18,18,480
Surplus „	39,12,645	„ „ 36,54,578

showing what a valuable property the Burma forests are to the State.

The Local Government's Review give us the statistics of export of teak from Rangoon and Moulmein during the last 5 years in the following table :—

	FROM MOULMEIN.		FROM RANGOON		TOTAL.		
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Average value per ton.
		Rs.		Rs.		Rs.	Rs.
1888-89 ...	93,465	77,21,819	62,969	48,99,547	156,434	1,26,21,366	80·7
1889-90 ...	80,871	70,05,857	103,560	81,84,843	184,431	1,57,90,700	82·4
1890-91 ...	64,227	47,01,434	110,888	78,75,794	175,115	1,25,77,228	71·8
1891-92 ...	62,320	41,88,267	99,647	75,13,397	161,967	1,17,01,664	72·2
1892-93 ..	106,850	72,57,412	109,338	91,85,043	216,186	1,64,42,455	76·06

The Tenasserim Report begins with an account of the Circle, which we think quite worthy of reproduction as a short and concise piece of information. After noting that the Circle covers about 35,308 square miles, of which 941 square miles may be roughly reckoned as cultivated land; that there are 4 forest Divisions; and that there are 1,877 square miles of reserved forest with 148 square miles of fire-traced area, and 9,339 acres of regular and taungya teak plantations, he goes on:—

“The teak forests which form the most valueable portion of the State forest property lie all in the northern half of the circle.

‘Teak, so far as has been observed, does not in Tenasserim extend much below the latitude of Yè, 15° 5'N; such stragglers of the species as are found further south being of poor growth, sickly, and ill-formed.

‘In past years the teak forests on the Thaungyin, Salween, and Yunzalin rivers, and more especially those in the valley of the Ataran, were the sources from which the supplies of the famous “Moulmein teak” were drawn. But for years past the yield has deteriorated both in quantity and immeasurably in quality, the forests having been ruthlessly worked mostly under the pernicious lease system, which still lingers in the five unexpired leases now running in the Ataran valley.

‘Besides teak, several other valuable woods, padauk (*pterocarpus*), kanyin (*Dipterocarpus laevis*), thingan (*Hopea odorata*), kaunghmu (*Shorea stellata*), pyinma (*Lagerstræmia*), pyinkado (*Xylia dolabriformis*), &c., are to be found in more or less abundance in Tenasserim, more specially in the southern forests, and until the teak forests under the State management and care now given to them shall have recuperated themselves, the forest outturn and revenue must, in the near future, depend largely on the introduction into the market of woods other than teak.

‘One of the great wants in the circle is the want of good communications in the interior. Practically speaking the rivers (many of which including the chief river, the Salween, are blocked by rapids) are the chief means of communication. Roads are few and far between; the extent of the roads made by the Public Works Department of the State is as yet small; and the country roads are mere jungle tracks leading from village to village, and liable to alteration, and even complete obliteration on the removal of a village-site.

‘It is this want of easy rapid communication that makes the forest administration of the circle difficult, and retards in many ways the introduction of a more thorough supervision and management of the forests.”

This account of the Circle shows that it is by no means an easy one to manage, and that good communications and commercial enterprise are required to bring into the market the splendid

timbers other than teak, of which there seem to be such a magnificent supply. Here seems to be the field for the development of the wood-paving trade which assuredly we, in India, have not done near enough to take advantage of. To an outsider, it would almost seem that the wants of the Circle in the way of communications might be met, at any rate on these rivers where there are good stores of suitable timber, by improvement of the navigation of the rapids by means of small locks and canals in some places, and in others by portages with short lengths of portable tramway. That a market ought to be got and can be got by perseverance for such timbers as 'padouk' and 'pyinkado' we feel quite sure, but rates will have to be cheap and profits small at first, for there are few things so difficult as to get new products into the market and to get new timbers into regular trade.

Major Bingham's remarks on a curious fact in regard to the natural reproduction of teak are worth quoting. He says:—

"As bearing on the natural reproduction of teak it is a noteworthy fact that there are many localities in Tenasserim where for some unknown reason teak seed rarely matures, and seed locally collected for sowing in taungya teak plantations is very often entirely worthless. For the last two years the supply of seed for taungya teak cultivation in this circle has been imported largely from the Pegu circle, and contrary to what was anticipated the results are far better than can be obtained with locally collected seed."

Taungya teak cultivation in Tenasserim seems to cost about Rs. 6-8 per acre, and in Pegu about Rs. 8-8 per acre.

The Pegu Circle extends over an area of 38,020 square miles of which 4,180 are under cultivation and 3,912 are Reserved Forest. There are seven Forest Divisions with a Working Plan Division and an Agency Division.

Mr. Carter's account of natural reproduction in the drier forests where bamboo abounds are interesting:—

"In the drier forests where the prevalent bamboo is myinwa (*Dendrocalamus strictus*) which flowers in patches almost every year, the natural reproduction of teak and other species is fairly good, and in such forests fire-protection not only improves the forest growth generally, but furthers the natural reproduction of teak. In the moister forests where the prevalent bamboos are tinwa (*Cephalostachyum pergracile*), and kyathaung (*Bambusa polymorpha*) which do not flower spasmodically, natural production is confined to gaps in the bamboo canopy which are not of frequent occurrence. In this forest fire-protection improves the general forest growth, and has a marked effect on the distribution of the water-supply, but it is not favourable to the natural reproduction of teak. The probable effect of continued fire-protection would be to increase the area of evergreen forest in which teak would not find a place if the forester trusted to natural reproduction alone.

'In the Kôn-Bilin forest we have a considerable area on which the tinwa flowered six years ago. A part of this area is protected from fire, and inside the fire-trace not a single seedling of any other species than bamboo can be found, while outside the fire-trace such seedlings are very few and far between. In the Pada forests of the Shwegyin division, in the area on which the tinwa flowered at the same time as in the Kôn-Bilin, a fairly good natural reproduction of teak has been noticed. More recently, in 1891, the kyathaung bamboo flowered over a large area of the Western division. The Divisional Officer states that the young growth of bamboo is 3 feet high, and is silent as regards seedlings other than bamboo. In the Toungoo division there is a fair reproduction of cutch over a limited area from which the mature cutch trees were removed four years ago.'

There is scarcely any question of silviculture in India or Burma so difficult as that of the reproduction of timber trees in bamboo areas, whether it be of teak in Burma or of Sál and other valuable trees in Bengal and elsewhere. The following remarks of the Pegu Conservator on the subject of the Europe market for teak deserve reproduction.

'The course of the Europe markets has been one of disappointment to shippers during the period under review. Prices which ruled at about £10-10 to £11 in the early months of 1892, declined to £9 to £10. The demand for teak for shipbuilding and for railway carriage construction was contracted. Planks were sold at from £9 to £10-10. The continental demand for teak has again increased, being fully 33 per cent. of the shipments to Europe as compared with 25 per cent. in the previous year. France bought largely for naval purposes, and there was the usual demand for Germany, Italy, Holland, Belgium, and Spain. There was no increase in the quantity of teak shipped to Europe from Siam, although the floating season 1892-93 was a favourable one, and fully 70,000 logs reached Bangkok during the year.

'The advance recorded in the last report was not of long duration, and timber not moving off freely in the selling markets, prices have declined again to about Rs. 65 to Rs. 70 for selected Indian squares and Rs. 55 to Rs. 60 for an inferior class of timber.'

The Upper Burma forests were, during 1892-93, divided into two Circles, Eastern and Western; the former containing at the close of the year 1,447 square miles and the latter, 822 square miles of Reserved Forest, with large areas of Protected Forest in addition.

One of the most interesting matters treated in the Eastern Circle Report is that of the difficulty of preventing illicit cutch boiling. Mr. Oliver says, in regard to this :—

“Sixty-nine cases were in connection with illicit cutch boiling and of these 49 out of the 54 that were taken into court resulted in convictions. The protection afforded to cutch during the year has been altogether inadequate. At the beginning of the season, in order to prevent the forests from being overworked, the issue of licenses was restricted to a limited number of cauldrons fixed for each district approximately in accordance with its capabilities. This led interested persons to investigate the law in the matter, and it soon became generally known that the Forest Department had no power to protect trees on land not at the disposal of Government. Owing to the growing scarcity of wood for boiling, the demand increased considerably, and people who had not sufficient cutch to make it worth while to boil it themselves, found a ready market at Rs. 3 per cart-load for the trees growing round their fields; not only have trees of all sizes been felled, but the stumps and roots have also been extracted, thus reducing the possibility of reproduction to a minimum. Cutch is consequently being fast exterminated in private lands. A further result of a better understanding of the Forest Regulations has been the manufacture in considerable quantities for the adulteration of cutch of *thansha* (decoction of *Terminalia Oliveri*) from trees grown on private lands.”

“The destruction of cutch trees would not have mattered so much if it had been confined to *bona fide* private property, but in many places, particularly in the Meiktila, Yamethin, and Shwebo districts, persons claimed as private property all land that had at any time been cultivated permanently or temporarily either by themselves or their ancestors together with the adjacent forest and proceeded to boil cutch on it. Land of this class includes practically the whole of the cutch forests in these districts. Some of it is no doubt private property, but to the greater part the claimants can prove no legal title. The Forest Department has, however, before it can interfere, to show in each case that the land is not private property, and it will be easily understood that with the weak staff available it has not been possible to cope with the difficulty, especially as in the cases that were successfully prosecuted, the small fines inflicted (which ranged from Re. 1 to Rs 30) have had no deterrent effect. Reservation of cutch tracts will no doubt be the best remedy for the present state of things, but until the controlling staff is strengthened progress in this direction must be slow.”

And there are very similar remarks to be found in Mr. Home's report on the Western Circle.

On the subject of natural reproduction, the Western Circle report has some interesting information which we reproduce.

“The general purport of Divisional Officers’ notes on this subject is that reproduction of teak, cutch, and pyinkado (*Xylia dolabriformis*) is naturally good, but that annual fires do not often allow the seedlings to survive over one season. This is only as must be expected, and until fire-protection is systematically carried out no practical improvement in this respect can be hoped for.

“The wabo (*Dendrocalamus Hamiltonii*) is reported to have flowered over extensive areas in the Nantainkwin forests in the Upper Chindwin, but it is too soon to judge with what effect as regards the reproduction of teak. The myinwa (*Dendrocalamus strictus*) was noticed to have flowered over considerable areas in the Upper Myittha near Anyaban and in the Sanni drainage; these areas, which were visited by the Conservator, were found to be one mass of fine Cutch seedlings, which will be destroyed almost entirely next season by fire; this bamboo has hitherto been observed to flower over small areas only annually, but the flowering over the localities named was more general than usual. The pyinkado flowered very freely in the Upper Chindwin.

We have read all four reports with great interest, and have endeavoured to select for reproduction the most interesting points, but there are many other matters of importance and interest, and for these we can only refer our readers to the Reports themselves.

Annual Administration Report of the Agricultural Department, Central Provinces, for 1892-93.

The only matters in this Report which are connected with the Forest Department are the references to 'Fodder Reserves' contained in paras. 18—19, which we reproduce as being the sort of thing which leads to unpleasantnesses and difficulties between Departments.

Para. 18 shows us that something in the nature of an 'opposition shop' is being started in the Central Provinces, that the Director of Agriculture is not satisfied with the ordinary professional agency, and that he is starting reserves of his own, and is going in for "strict conservation" with no "desire to gain an income for Government." It is just possible that the financial authorities of Government may not look upon this generosity in quite the same light: with the rupee at only a little over a

shilling, deficits to be met, economies in every branch of the administration to be carried out, and taxation of the least unpleasant kind to be provided, it is not improbable that Mr. Fuller's philanthropy may not be quite so acceptable as he seems to think it will be. His little reflection on the income-gaining propensities of forest officers is not worthy of the pen of a Head of Department.

We have to work, practically and financially, on the lines which Government lays down. It cannot say to us, however, "we expect so many lakhs of rupees surplus revenue, but you must not charge for forest produce." As forest officers only, it is all one to us if the Government gives away *all* its produce *gratis*, provided that it does not make us accept the responsibility for doing so, and provided that we are permitted to manage the forest estates with a due regard to the maintenance and improvement of the capital. We are the servants of Government just like Mr. Fuller, and the Chief Commissioner has as fully the authority to regulate the proceedings of the forest officers, as he has over agricultural experiments. The narrow-minded view of the object of the Forest Department taken in para. 19 is, however, not likely to commend itself to any statesman, who can understand that the Department has other clients than agriculture; and that there could not be a worse policy than to manage it solely in the interest of one. We quite think that the authorities should (and probably do) consult the Director of Agriculture on questions relating to the Department, just as they would consult the Chief Engineer on matters where Public Works interests were concerned, or the Accountant General on questions of finance. What we want to see and what we are sure that our Government, Imperial or Local, really desires, is a complete '*entente cordiale*' between all its officers, of whatever Department they may be; and we think it a great pity that such statements as those we quote should find place in a Government Report:—

"The acquisition has been completed of eleven plots of unculturable land in the densely populated area of the Raipur and Bilaspur districts, to be managed as Fodder Reserves in the interests of the people. In regard to the Fuel and Fodder Reserves which were established in the Sambalpur district at its recent re-settlement the Deputy Commissioner writes that they are managed in the Revenue Department by Patwaris and Inspectors, and are improving in condition. Stricter conservation is to be enforced, but I trust that it will not be influenced by any desire to gain an income for Government.

'Experiments undertaken in this Department on the barren range of trap hills near Nagpur to ascertain whether jungle growth could be assisted by sowing seed, have so far resulted in failure, but will be continued during the present year on rather different lines.

“The term “Fuel and Fodder Reserves” customarily refers only to a few small plots of land which have been specially taken up during the past six years, but as a matter of fact the greater portion of the Government Forest Reserves—covering nearly 20,000 square miles of country—is of practical value as subsidiary to agriculture and not as a source of commercial products. The sale of timber constitutes indeed quite a minor item in the revenue of the Forest Department, which represents in great part money paid by the agricultural population for services or supplies connected with their cultivation. My long acquaintance with the rural circumstances of the Provinces may perhaps be held to justify the expression of my opinion that the management of the Forest Department too often ignores the essential connection between its lands and those under cultivation, and follows lines which, however efficacious in producing revenue, are calculated to cramp, not to develop, the agricultural resources of these Provinces. It would be out of place here to instance in detail cases with which I have to support this view. The question is one with which I have had no official connection, and the representations on particular cases of hardship which I have from time to time submitted to the Forest Department have naturally suffered from the appearance of gratuitous criticism. I trust that I may be pardoned for venturing to record here that, in my judgment, more is required to ensure that questions of Forest management and Forest rates which are connected with the practices and requirements of the agricultural population, are not decided without full and careful consideration on the agricultural side, and that the Director of Agriculture should be formally authorized to institute proceedings for the modification of arrangements which are prejudicial to agricultural development, and should be given a voice in the introduction of changes, whether of system or rates, which will affect the circumstances of the agricultural population.”

Administration Reports of the Madras Government Museum and Nilgiri Parks and Gardens, for 1893-94.

The first of these reports is an interesting and well-written one, evidently written by the Superintendent himself, and not merely compiled in conventional style by the office clerks. It is probable that the Madras Museum is the best managed institution of the kind in India; it is somewhat crowded, but is bright and pleasant, and in that way contrasts very favourably with the rather dreary galleries at Calcutta. But in the Report there is, naturally, not much to interest us professionally, except that the Economic Museum includes forest products, and has made a good beginning. The Nilgiri Botanical Gardens' report is also

interesting, and there are notes on some forest products, which are of interest. The following regarding the *Cassia auriculata* shrub shows that the Superintendent has not heard of its having been cultivated successfully in the plantations on poor laterite soil near Rajampet in the Cuddapah District:—

"*Cassia auriculata*.—Messrs. Cooper, Allen and Co., of Cawnpore, asked for information respecting the cultivation of the '*Cassia auriculata*, and were told that, so far as was known in this department, the plant was never cultivated, but was obtained as a minor forest product; but that if they wished to cultivate it, it was believed that it would not need irrigation, as in a wild state it grows in hot dry places. It was also pointed out to Messrs. Cooper, Allen and Co. that if they undertook its cultivation, they should allow it to grow for several years before barking the shrubs; as Mr. Hooper's analyses had conclusively proved that the bark taken from old stems was many times richer in tanning than that taken from young stems or branches."

It is not very easy to start, but we believe that when once started it might be cultivated as a crop quite easily, though perhaps the winter at Cawnpore might prove a little too cold for it. We would recommend trying it sown broadcast on well ploughed land, the seed having been previously well-soaked to assist germination.

It is reported that blue-gum oil is now regularly prepared by private firms who sell it wholesale at from Rs. 2-4 to 2-8 per lb.

The *Ceara* and *Castilloa* rubber trees at Barliyar were again tapped, but with very poor results, though what was obtained proved to be of very good quality.

VI.—EXTRACTS, NOTES AND QUERIES

The New System of Coupes in the C. P.

We have received from Mr. G. F. Taylor a photograph showing one of the new coupes with the standards left as reserves. The picture gives a good idea of the style of the operations which have recently been started, and which will do much to improve the forests as well as to provide material for the use of the country. The number of standards left is 60, and the photograph shews these with a broad mark of white paint around them. Our acknowledgments are due to Mr. Taylor for his interesting communication.

Seeding of Forest Trees.

Pterocarpus Marsupium is reported to be seeding well all over the Palni Hills, Madura District, Madras, this year. The seed is now well developed, and promises a good crop in October and November.

Bamboo Seeding in Bengal.

Mr. F. Trafford, Assistant Conservator of Forests, Tista Division, Bengal, writes to say that the 'Tama' bamboo (*Dendrocalamus Hamiltonii*) is flowering abundantly this year, and that large quantities of the seed can be collected, if required.

Foresters as Cyclists in France.

We notice in a recent number of *Revue des Eaux et Forêts* that a circular has been issued to all Conservators of Forests in France from head-quarters, informing them that in future Forest Officers up to and including 'Inspecteurs' are to be exempt from the velocipede tax imposed by the law of 28th April 1893. The Resolution requires that Conservators should satisfy themselves that the concession is not abused, and to this effect it has to be certified that the possessor of the velocipede uses it in the public service.

It is stated that experience has shown how extremely useful these machines are to members of the Forest Service by whom they are very largely used. That this would appear to be the case is also indicated by an article of the Resolution, which provides for the exemption of departmental velocipedes also when in use by members of the department.

It is not stated whether the term velocipede includes the tricycle or not; we trust it does, as this will 'no doubt' be a matter of interest to some of the less active members of the department.

The Restoration of Scenery.

The preservation of scenery, by making "natural pictures" a kind of public property, to be preserved and kept for the æsthetic enjoyment of the people, just as paintings are purchased and preserved for the same purpose, has more than once been advocated in the *Spectator*. Professor W. R. Fisher, in communicating to the *Daily Chronicle* some observations made in the industrial districts of the Belgian Ardennes, and subsequently in the Black Country of our Midlands, "goes one better." He sees his way

to a plan for the restoration of scenery ; and unlike the restorers of "genuine old masters," who made a mystery of their doubtful craft, he gives full details of his experience in both countries, and his conclusions as to the treatment necessary. It was when staying at Château Mirwart, in Belgium, that he first conceived the idea of "restoring" the Black Country. He saw vigorous ash and sycamore trees growing on heaps of glassy slag from an abandoned iron-furnace. That kind of slag is almost the least promising material for woodland soil which can be imagined. It is hard as glass, breaks into shiny lumps, like the "rock" sold on sweetstuff-stalls in the streets, and has very seldom been put to any useful purpose. At Middlesbrough, where, on the shallow, muddy, dull banks of the Tees estuary, there was never any "scenery" worth looking at at all—the Black Country of Cleveland is hardly less picturesque than the sour flat fields which once fringed the ugly estuary—they "dumped" hundreds of thousands of tons of slag along the banks, and gained a deeper river and a firm bank and quay. But it does not grow trees yet. Probably it never will. But as the trees grew in the slag, or among the slag, in the Ardennes, the idea occurred to Professor Fisher that the great "spoil banks," or heaps of all sorts of soil dug out of the pits before the coal or iron is reached, might just as well be planted with trees in England. If they were set with the quickly growing kinds used for mine props, the enterprise might be profitable as well as picturesque. The soil in these mounds is by no means of the forbidding character which appears on the surface. The deeper the mine, the more rocky, as a rule, is the debris extracted ; but this, which is taken out last, and scattered on the surface, often conceals thousands of tons of good soil piled below. There is, therefore, no reason why the colliery and ironstone countries should not be covered with wooded mounds, wherever a worked-out or disused pit now marks the surface with an ugly and disfiguring scar. Scotch fir, a rapid-growing, hardy, and self-sowing species, is clearly the tree for the purpose. Moreover, it is in great demand for prop timber, and the estimate of 70,000 tons imported for that purpose quoted by Professor Fisher, is probably far below the mark. Some such effort at restoration of ruined scenery seems to be entertained in a different quarter. From the Welsh coal-districts there comes a separate and independent demand for "afforesting," partly with a view to a supply of mine-timber. Mr. Lloyd-George and other Welsh members drew attention in the discussion on Supply to the need of replanting Crown lands in Wales with timber, the present destruction of which made it necessary to buy mining-props in France. Sir John Hibbert was able to reply that their wishes had the sympathy of a Commissioner of Woods and Forests, who was then engaged in a tour, in order to discover how far the project could be made to pay, and whether the local feeling was

in favour of planting. In the true Black Country, Professor Fisher found conditions somewhat different from those generally seen in a country whose amenity has been destroyed by manufacture. The cause of the early destruction of the scenery, and the early wealth of the Black Country, was the wonderful coal seam which ran beneath it, and its nearness to the surface. In one of the largest mining enterprises of the last few years shafts of twelve hundred yards deep were sunk to reach the Barnsley seam of $9\frac{1}{2}$ ft. thick. In 1850 a seam *thirty feet thick* ran so close beneath the surface in parts of Staffordshire and Worcestershire that, according to Professor Fisher, nearly every one who had land above it dug an independent shaft, and the debris from these numberless shafts has spread over many thousands of acres of land, rendering the surface too uneven for agriculture. "Here and there, in depressions," writes Professor Fisher, "I found a small vegetable garden and orchard, but the rest of the land consists of heaps of shale, which has disintegrated into a clayey loam, and is covered with a coarse growth of grass, presumably used for sheep pasture, though I saw no sheep on it. I was told that it cost about £100 an acre to level this land, and the present state of agriculture in England would not warrant this expenditure. What it would grow, and grow well, is a crop of trees; but the obvious difficulty in the way of such a proposal lies in the danger to the growing trees from the noxious fumes of the surviving manufactories. In order to find out how far this was a still-existing danger in the Black Country, Professor Fisher invited Mr. Harbord, the Chemical Analyst to the Government of India at Cooper's Hill, to accompany him to Birmingham, Dudley, Bilston, and the neighbourhood of Wolverhampton. They found that the waste tract which has been described, on which there are now no furnaces, and on which the pits have been closed for years—one of those awful instances of a bit of "used-up England," which suggest to some minds a time when the populous North may become one huge burnt-out cinder-heap—was remote enough from the manufactories both of Wolverhampton and of Bilston, for there to be no danger to trees from acid fumes. Moreover, the the actual number of furnaces at work is not more than one-half of those in blast thirty years ago, and these are better constructed and give out less smoke. The presence of trees is witness to this. "There is fine growth of ash and sycamore and poplar in Dudley Park, on the verge of the Black Country, to the west of the Earl of Dudley's extensive iron and steel works; there are fine sycamore, ash, beech and even Scotch fir-trees, growing in some private grounds, although it is well known that Scotch fir and beech do not thrive when exposed to acid fumes." Professor Fisher's conclusion is that there is not sufficient smoke in the Black Country to injure trees, and that the waste land and old pitshafts might be planted, and the hideous scarred country turned into a forest, "if Government or local authorities would support such a measure."

It is not often that such practical proposals result from a "sentimental journey" through a factory-ruined district. A far more usual course is to abuse or deplore the establishment of the factories themselves, which are the result of economic needs that must be stronger than æsthetic antipathies. There is no reason to doubt that in the case of parts of the Black Country, scenery can be restored on the lines suggested by Professor Fisher, and the experiment is as well worth considering by the local governing bodies of the wealthy Midland towns as the project of re-afforesting the Welsh Crown lands by the "sympathetic Commissioner," from whose good offices Sir John Hibbert expects so much. But there are districts in which manufactures are still carried on in such a manner and of such a kind as are incompatible with any restoration of scenery, even supposing it were worth living in the vicinity, were the landscape the finest which could be seen. Take, for instance, that "chemical" district west of Manchester, of which Widnes and St. Helens are the commercial centres. In this scene of unrivalled British enterprise, the ground is like a dead sea-shore of alkali waste, the air smells horribly all day and all night, trees die, eyes smart and lips are dry and cracked from chemical fumes, and soda, glass bottles, and pills in millions are the result to civilisation. They will go on being made, and the trees will go on dying, until the world has enough soda, glass bottles, and pills, or till it does not pay to make them. In Jarrow-on-Tyne, the other centre of the chemical industry, the fumes killed all the trees on the hilltops like a frost, but spared those in the valleys. It is said that they too are dying. The river is fringed for miles with old-established chemical works, dating in many cases from a time when waste and carelessness in manufacture were unchecked by the invention of improved processes abroad, the manufacture of chemicals was conducted at a minimum of profit to the owner, with a maximum of injury to vegetable life, and interference with human comfort. Improved methods of manufacture, which turn the noxious "waste products" into something useful, are the great protection to trees and vegetation, and such improvements are being introduced at Jarrow. But the scenery of Tyneside is not yet ripe for restoration; and if our fiery districts are cooling from the centre, as seems probable, the Midlands seem the natural and best locality for an experiment in the restoration of scenery.—(*Spectator*, August 25th, 1894).

VII.—TIMBER & PRODUCE TRADE.

Churchill and Sim's Circular.

September 5th, 1894.

EAST INDIA TEAK.—The deliveries for the first eight months of the year are 7,754 loads against 8,783 loads in the same period of 1893, while for August they came out at 817 loads against 1,157 loads in August, 1893. The London Stock continues very moderate, and prices tend to improve. They would do so much more markedly but for the figures of the floating supply and the number of slips chartered to load. This prospective supply promises to meet, however, with a sufficiently widespread and general demand to prevent the probability of any undue proportion of it pressing very severely on any one market.

RED-WOOD.—Is in very limited demand, although stock is small.

SATINWOOD.—Plain wood is dull of sale, but figury logs are in good demand.

EBONY.—There is more enquiry, and really good logs bring satisfactory prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to	£16
Satinwood	per foot superficial	6d.	to	12d.
Rosewood	„ ton	£5.	to	£8.
Ebony	„ ton	£6.	to	£8

MARKET RATES OF PRODUCTS.

Tropical Agriculturist, September, 1894.

Cardamoms	per lb.	2s.	to	2s. 6d.
Croton seeds	per cwt.	20s.	to	27s. 6d.
Cutch	„	20s.	to	32s.
Gum Arabic, Madras	„	15s.	to	30s.
Gum Kino	„	£15	to	£18.
Indian Rubber, Assam,	per lb.	1s. 7d.	to	2s. 2d.
„ Burma	„	1s. 7d.	to	2s.
Myrabolams, Bombay,	per cwt.	7s. 6d.	to	9s. 3d.
„ „	„	3s. 6d.	to	4s. 3d.
„ Godavari	„	6s.	to	6s. 9d.
Nux Vomica, good	„	6s.	to	10s.
Orchella, Ceylon	„	15s.	to	22s.
Redwood	per ton	£3. 10s.	to	£4
Sandalwood, logs	„	£35	to	£55
„ chips	„	£9	to	£30

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Recruits for the Upper Controlling Staff of the
Forest Department.

Some information with regard to the nature of the examination which competitors for the Indian Forest Department are now required to pass, appeared in the January number of *The Forester* of the present year. The results of the examination held for candidates for six appointments to the Indian Forest Department last June are now public property, and a few additional remarks with regard to the arrangement of the subjects, which may now be taken up and its effect on the character of the examination, may be of interest to your readers.

The subjects which may be taken up are, as was the case in June, 1893, divided into three classes:—

Class I.—*Obligatory*.

Class II.—*Optional*, with the proviso that only two of the nine subjects which are included in this course, may be taken up by any one candidate.

Class III.—*Voluntary*. This term embraces a small group of subjects, which may *all* be taken up—and were all taken up—by every candidate.

Class I includes Elementary Mathematics, English Composition and German.

Class II contains Higher Mathematics, French, Latin, Greek, English History, Elementary Botany, Elementary Chemistry, Elementary Physics and the elements of Geology.

Class III consists of Freehand and Geometrical Drawing. Thirty-nine men presented themselves for the six places offered for competition, and every candidate in addition to the obligatory subjects took up both the voluntary subjects included in Class III.

This seems to indicate that the candidates would have all taken up more subjects if they had been allowed to, and that the system at present in force has a tendency to confine the knowledge of a candidate within comparatively narrow limits.

The maximum number of marks which a candidate could obtain was 10,800, and of this number the first man got 6,883, and the last successful candidate obtained 6,501, and the 39th man 3,140. Had any of the first six men omitted to take up the voluntary subjects, they would not have obtained an appointment. All the successful candidates, with one exception, obtained more than half marks in each of the obligatory subjects.

Of the optional subjects 34 men out of the 39 candidates took up French, 28 took up Latin, 7 Chemistry, 7 Geology, 3 Physics, 3 English history, 2 Botany. No one took up Greek, which seems to point to the influence of the modern school side of the public educational establishments of the present day.

It is a matter for congratulation that so many candidates took up French as one of their optional subjects, but it is much to be regretted that of the whole number of candidates who presented themselves for examination, only 3 selected two of the branches of Natural Science as their two optional subjects, and also that neither of these men were among the successful candidates. Of the remaining competitors, only 13 attempted even one of the four branches of Natural Science open to them !

The competitive examinations for *Forest officers and Police officers* are, it is understood, identically the same, and are held together. This arrangement may save the examiners trouble, but is it possible to bring together two professions which have so little in common ? A Forest officer must be, or be made, more or less a scientific man, and should be essentially a student of nature ; while a Police officer requires no science, and has chiefly to learn the characteristics and peculiarities of his fellow men, and yet one and the same examination is held to be sufficient test for the selection of men for both these services !

Forestry has long been practised in France, under much the same wide conditions as in India, and as the Indian Forest service has been so long and so intimately connected with the French service, a thorough knowledge of French is just as important to an Indian Forest officer as is a good and sufficient knowledge of German. French is more generally taught at schools, and is more easily acquired, at any rate up to the standard required to enable a forest officer to travel with profit in France, and to read professional works in French with advantage. It ought to be certainly, therefore, a compulsory subject just as much as German is. The Entrance examination test in 1885, the first year that men were sent to Coopers Hill, was similar to that which was in vogue

when men were sent to France. All the subjects, with three exceptions, were compulsory. These three exceptions were Free-hand drawing, Geology and Mineralogy, and, I think, Botany. The elements of Physics, Chemistry and Mechanics were all compulsory subjects, and rightly so.

The changes in the syllabus of the competitive examination appear to have been made with a view to attract public school men, as the subjects which are required seem to have been altered so as to fit in with the ordinary school curriculum, where the modern side has not been properly developed. The result of the change of the syllabus has been that men who have no knowledge of the chief branches of natural science are attracted, instead of, as formerly, men who had devoted a considerable proportion of their time to those subjects.

Only one of the six successful candidates at the examination held in June and July last, took up any of the branches of natural science, and he only took up one of the newer branches offered, namely Physics ! Of course, it may be urged that the natural sciences are taught at Coopers Hill, but is it not a fact that they can be taught equally well elsewhere ? And also that if the men who now enter the Forest Department were required, as they were formerly, to have a thorough knowledge of Elementary Chemistry, Physics and Geology, more time would be available for their instruction in those subjects which they should know and which cannot be thoroughly acquired in public schools and similar educational establishments ?

A man who has studied science for pleasure, should, other things being equal, make a better Forest Officer than one who has no inclination for scientific subjects, and consequently natural science should be required from such students as offer themselves as candidates for the Forest Department, in order to ensure, as far as is possible, their having a taste for those subjects which, when developed, will prove most valuable to a Forest Officer.

A third year has lately been added to the course of instruction of Forest Officers at Coopers Hill. May it not be that those advantages which ought to accrue from this third year are annulled to a great extent, by the fact that now students have to devote their first year to courses of Chemistry, Physics and Geology, none of which were *necessary* in the case of the students who passed in under the old régime.

Under that régime, at first, French and German were obligatory subjects in turn, and latterly French was made obligatory and German entirely dropped. This was, of course, a mistake, as one language is as important to a Forest Officer as is the other ; but now the pendulum has swung to the side of German to the neglect of French, and is not this just as bad as the total neglect of German ?

A two years' course at Coopers Hill was considered to be too short, but is much time gained by increasing it to three years, if at the same time three extra subjects are added, and Botany has to be taught from the very commencement?

From the first, forest students have been required to attend the College lectures in Geology and Physics, but this was quite unnecessary in view of the character of the examination which the successful competitor had already gone through.

The ordinary college course of Chemistry is very much longer, and takes up very much more time than either Physics or Geology, and if the forest students are to follow this course, and learn as well organic chemistry, which does not form a part of the ordinary college curriculum, the time at their disposal for the other subjects which they are to learn will be necessarily considerably shortened.

In order that full advantage may be taken of the extra year at Coopers Hill, an elementary knowledge of lower mathematics is necessary, and an elementary knowledge of Latin, and possibly Greek, will be found useful, in so far as they enable the student to analyse the exact meaning of the numerous scientific terms which will be met with in the study of the different branches of natural science. These subjects, as well as a good knowledge of elements of Physics, Chemistry and Geology, should be obtained at a public school before entering the College, and then the third year can be utilized in teaching those subjects which particularly and peculiarly belong to the training of a forest officer. Given two men of equal ability, it stands to reason that a man who has a knowledge of and presumably a liking for the natural sciences, such as Botany, Chemistry and Physics, would be undeniably preferable and better qualified as a forest officer than one who has simply passed into the department on his knowledge of Higher Mathematics, Latin or Greek. One would like to see the syllabus of the entrance examination altered, so as to bring it more in accordance with the old régime; so that Class I—*obligatory*—should contain Elementary Mathematics, English Composition, German, French, and the elements of Chemistry, Physics and Geology; that Class II should be done away with, and that Class III—*voluntary*—should embrace Botany, and, as at present, Freehand and Geometrical Drawing.

Botany, with especial reference to forestry, is very thoroughly taught at Coopers Hill, and the course is especially adapted to the requirements of a forest officer in a way which cannot be done at other institutions where general botany is taught, and it is considered desirable that this subject should be taught from the very beginning at the College.

C. G. R.

Punishments for Cattle trespass.

In a Note on Forest Policy in Bombay, published last month in the *Forester*, the Inspector General of Forests expresses his views on the procedure adopted in the matter of cattle trespass. The question is of importance and justifies discussion. Mr. Ribbentrop is averse to the award of a double punishment under the same law; he would rather (1) increase the pound fees, (2) withdraw the grazing concession, or (3) increase the grazing fees charged. The award of double punishment under the same law is, doubtless, in the abstract, repugnant to a sense of justice, but there is no novelty in the proceeding, nor do those who are so punished resent the punishment from this point of view. In the case of field trespass by swine, these animals may, I believe, be impounded, and the owner prosecuted for permitting the trespass. Simple impounding is thus not deemed to be sufficiently deterrent where much damage may be caused to the crops.

Forest trespass is more difficult to prevent than field trespass, and it is not apparent why one and the same procedure should be deemed unjust when applied to forests, and suitable when applied to arable lands. Personally, I am of opinion that the so-called double punishment is ideal, as the Magistrate in sentencing a trespasser would invariably take into consideration the amount already paid for releasing his cattle from the pound. To consider the alternatives proposed: first, to increase the pound fees; this would prevent a discrimination between the casual and habitual offender, and would level up all offences, whether committed by carelessness or by intention. It would also intensify the results of vexatious impounding, a so common outcome of personal animus in this country.

Secondly, the withdrawal of the privilege of grazing at reduced rates; and, *thirdly*, the increase of the normal grazing fees. These two proposals may well be considered together, in each, the community might be punished for the faults of individuals, in each, the action taken would not be deterrent unless the increased payment more than covered the value of systematic illicit grazing. It goes without saying that a village community thus punished would not, in the basis of this discussion, be otherwise proceeded against for continued trespass. The total prohibition of grazing to a village is too drastic a measure, it involves the existence of the agriculturalist; the increase in grazing dues tends in the same direction, and might, in a community, arrive near the same result before it was effective in individual cases.*

* For instance the habitual offenders in a community might be of the cattle breeding castes, with no interest in agriculture. The agriculturalists might be unable to prevent the trespass, and yet be made to suffer severely by the imposition of increased grazing dues.

I venture to bring forward a fourth proposal which would obviate the difficulty of the double punishment, and yet permit the Forest Officer to discriminate between degrees of offences and the Magistrate to award punishment proportionate thereto. This proposal is to abolish pound fees for forest pounds, but to continue to use these institutions as a sure and, at present, the only means at our disposal for the identification of trespassers. The Forest Officer must be in a position to deal with the habitual offender (whose sentence may be, and often is, three months' rigorous imprisonment and Rs. 100 fine) and the careless herd who is released on payment of pound fees, or compounds his offence by disbursing a trivial sum. The registers of the law courts afford the proofs of habitual misdeeds; to punish solely by impounding would be to do away with this information, and so prescribe one punishment for offences which vary in degree.

Little need be said as to the working details of the proposal. The up-keep of forest pounds would involve an expense which the finances of the Department could well bear. The pound keeper would be an official of local knowledge not liable to be deceived by fictitious names and addresses. The receipt of the owner of the cattle on removal would be taken as evidence of ownership, and the Magistrate before whom the case would be decided, would know how to deal with any complications which might arise under the new system of the abolition of pound fees.

O. C.

Modification of French Forest Law as regards the
power to give light sentences in the case of
forest offences.

A proposition has been presented to the French Chamber of Deputies, with the object of bringing about a modification of Section 203 of the French Forest Code, which at present prohibits the application of the attenuating circumstances of Section 463 of the Penal Code to forest offences.

The proposers of the modification maintain that there is no reason why the Forest Law should be the only law which leaves no power of appreciation with the Courts. A judge who convicts under the present law, is obliged to award a certain sentence which, in many cases, is out of all proportion to the offence committed; the only alternative he has to awarding an unduly severe sentence is to acquit, which is obviously equally undesirable. To take an example. In the case of cattle trespass, Section 199 fixes the fine at so much a head; no discrimination is allowed as to whether

the damage caused was grave or trivial, whether the trespass was an accident or owing to ignorance, or was of deliberate intent. The offence exists by the simple fact of the trespass, and there is no question of anything else.

Again, when damages are recoverable from an offender, they cannot, by Section 202 of the Forest Code, be less than the fine awarded, whatever may be the extent of damage ; and it is obvious that in many cases to award the minimum damages fixed by the Code would be equally unjust as to refuse to award damages at all, between which limits there is no middle course.

The arguments in favour of the present order of things appear to be based chiefly on two considerations. First that a rigorous law is indispensable for the proper conservation of the forests. As to this, it seems more than probable that its very rigor is the cause in many cases of its inefficacy, as, for instance, in such cases as those in which the Court has to choose between an acquittal and a sentence to a punishment out of all proportion to the offence. Secondly, it is alleged that the Forest Administration is invested with the right of compounding forest offences, and that it is thus able to modify, when necessary, the severity of the forest law. That forest officers should be authorized to compound offences is, of course, quite right and proper, but the exercise of the authority depends, after all, on the individual ; and without denying that a conciliatory spirit is generally displayed by officers of the department, yet the proportion of cases compounded naturally varies with the officer competent to accept composition. The proposers of the modification in question maintain that even supposing forest officers were never influenced by any other considerations but those of justice in accepting or refusing composition, yet the power to admit of attenuating circumstances is none the less necessary for the Courts. The power to accept composition exists also under other laws, but has not in any other case prevented the admission of attenuating circumstances by the Courts.

The following article appears in *Le Bois* on this subject :—

“It would be easy to reply that the Forest Code was drawn up with a perfect understanding at all points in order to protect efficaciously forest property, and more especially that of the State and the Communes in the interests of the country at large, that it was necessary to adopt severe measures to repress old-standing and numerous abuses ; but that as the conditions became simpler, the rigour of the law has been considerably moderated without actually altering the text, that notably the system of compounding offences so largely made use of in the Forest Administration has long since procured all the leniency which is compatible with the up-keep of the forests. In our time, however, the general good of the country at one time so deep and lively a sentiment, has now given place to electoral interests, it is therefore extremely probable that the Chamber will receive favourably the project which has been submitted to it.—(*From the Revue des Eaux et Forêts.*)”

II.—CORRESPONDENCE.

Value of 'Pynkado' for Sleepers and Paving Blocks.

SIR,

As there has been some correspondence in the papers lately on the subject of the value of *Xylia dolabriformis* for railway sleepers and for wood-paving purposes, the following extracts from home reports of the value of the wood in the London market will be interesting :—

"We have examined your plank of wood per *Arapalu*, and find same to be a very hard wood, close grained and with a strong tendency to split on the flat side, it does not appear to possess any special merit, and we do not think shipments would realise enough to cover freight and charges, and we certainly cannot recommend you to make any consignments."

Another report says :—

"We have not yet found anyone to take an interest in the Jamba. It is so hard that the expense of cutting into blocks would be excessive, and the railway Companies here will not use it for sleepers, as it makes the trains too noisy, they insist on having pine-wood, which being more springy is quieter."

The North Kanara forests in the Bombay Presidency could supply 1 to 2,000 tons of this timber annually at Rs. 40 per ton delivered at the railway-stations of Alnawur or Londa, Southern Mahratta Railway.

W. A. TALBOT,
D. F. O., N. Dn., Kanara, Bombay.

Albizzia lophantha at the Cape.

SIR,

In a recent number of the *Indian Forester* I notice your remarks about *Albizzia* or *Acacia lophantha*. My opinion of it quite coincides with yours: and I am at a loss to understand why the Punjab Forest Department should seek to propagate it. In the Cape Peninsula it is a naturalized weed, in the sense that it overruns fertile ground, but will not grow in dry or poor localities. On the fertile slopes of Table Mountain it grows in many places like

Acacia dealbata on the Nilgiris. In dry localities on the mainland, where other wattles, notably *Acacia Cyclopis* (?) flourish, *A. lophantha* is never seen. Its bark is worthless for tanning purposes. It is notorious in Cape gardens as being the chief home of that pest of all pests, the Australian bug, *Icerya Purchasi*. There are 2 species of wattle that, judging from S. African experience, are most likely to succeed in the Punjab, *Acacia Cyclopis* and *A. saligna*. Both are quite naturalized in S. Africa. We collect tons of the seed yearly for re-foresting, chiefly for the barren sands of the Cape flats. The *saligna* wattle furnishes a good tanning bark, largely used in local tanneries. The *Cyclopis* wattle is of no value for tanning purposes, but does well on barren hillsides and on limestone; it is now found all along the coast of S. Africa, especially at Port Elizabeth and Mossel Bay.

The valuable black wattle, *A. decurrens*, has no doubt been well tried on the Himalayas. As a curiosity I send you South African seed of this and of the other very valuable tan wattle, *A. pycnantha*.

CAPETOWN,
August 28th, 1894.

D. E. HUTCHINS,
Cons. Forests.

III.-OFFICIAL PAPERS & INTELLIGENCE.

Resolution on the Forest Policy of the Government
of India.

In Chapter VIII of his Report on the improvement of Indian Agriculture, Dr. Völcker dwells at length upon the importance of so directing the policy of the Forest Department that it shall serve agricultural interests more directly than at present; and in his Review of Forest Administration for 1892-93, the Inspector-General of Forests discusses in some detail the principles which should underly the management of State forests in British India. While agreeing generally with the principles thus enunciated by the Inspector-General of Forests, the Government of India think that it will be convenient to state here the general policy which they desire should be followed in this matter; more especially as they are of opinion that an imperfect apprehension of that policy has, in some recent instances, been manifested.

2. The sole object with which State forests are administered is the public benefit. In some cases the public to be benefitted are the whole body of tax-payers ; in others, the people of the tract within which the forest is situated ; but in almost all cases the constitution and preservation of a forest involve, in greater or less degree, the regulation of rights and the restriction of privileges of user in the forest area which may have previously been enjoyed by the inhabitants of its immediate neighbourhood. This regulation and restriction are justified only when the advantage to be gained by the public is great ; and the cardinal principle to be observed is that the rights and privileges of individuals must be limited, otherwise than for their own benefit, only in such degree as is absolutely necessary to secure that advantage.

3. The forests of India, being State property, may be broadly classed under the following headings:—

- (a) Forests, the preservation of which is essential on climatic or physical grounds.
- (b) Forests which afford a supply of valuable timbers for commercial purposes.
- (c) Minor forests.
- (d) Pasture lands.

It is not intended that any attempt should be made to class existing State forests under one or other of these four heads. Some forests may occupy intermediate positions, and parts of one and the same forest may fall under different heads. The classification is useful only as affording a basis for the indication of the broad policy which should govern the treatment of each class respectively ; and in applying the general policy, the fullest consideration must be given to local circumstances.

4. The first class of forests are generally situated on hill slopes, where the preservation of such vegetation as exists, or the encouragement of further growth, is essential to the protection from the devastating action of hill torrents of the cultivated plains that lie below them. Here the interests to be protected are important beyond all comparison with the interests which it may be necessary to restrict ; and, so long as there is a reasonable hope of the restriction being effectual, the lesser interests must not be allowed to stand in the way.

5. The second class of State forests include the great tracts from which our supply of the more valuable timbers—teak, sal, deodar, and the like—is obtained. They are for the most part (though not always) essentially forest tracts, and encumbered by very limited rights of user ; and when this is the case, they should be managed mainly on commercial lines as valuable properties of, and sources of revenue to, the State. Even in these cases, however, customs of user will for the most part have sprung up on the margins of the forest ; this user is often essential to the prosperity of the people who have enjoyed it ; and the fact that its extent is limited in comparison with

the area under forest renders it the more easy to continue it in full. The needs of communities dwelling on the margins of forest tracts consist mainly in small timber for building, wood for fuel, leaves for manure and for fodder, thorns for fencing, grass and grazing for their cattle, and edible forest products for their own consumption. Every reasonable facility should be afforded to the people concerned for the full and easy satisfaction of these needs, if not free (as may be possible where a system of regular cuttings has been established), then at low and not at competitive rates. It should be distinctly understood that considerations of forest income are to be subordinated to that satisfaction.

There is reason to believe that the area which is suitable to the growth of valuable timber has been overestimated, and that some of the tracts which have been reserved for this purpose might have been managed with greater profit both to the public and to the State, if the efforts of the Forest Department had been directed to supply the large demand of the agricultural and general population for small timber, rather than the limited demand of merchants for large timber. Even in tracts of which the conditions are suited to the growth of large timber, it should be carefully considered in each case whether it would not be better, both in the interests of the people and of the revenue, to work them with the object of supplying the requirements of the general, and in particular of the agricultural, population.

6. It should also be remembered that, subject to certain conditions to be referred to presently, the claims of cultivation are stronger than the claims of forest preservation. The pressure of the population upon the soil is one of the greatest difficulties that India has to face, and that application of the soil must generally be preferred which will support the largest numbers in proportion to the area. Accordingly, wherever an effective demand for culturable land exists, and can only be supplied from forest areas, the land should ordinarily be relinquished without hesitation; and if this principle applies to the valuable class of forests under consideration, it applies *à fortiori* to the less valuable classes which are presently to be discussed. When cultivation has been established, it will generally be advisable to disforest the newly-settled area. But it should be distinctly understood that there is nothing in the Forest Act, or in any rules or orders now in force, which limits the discretion of local Governments, without previous reference to the Government of India (though, of course, always subject to the control of the Government) in diverting forest land to agricultural purposes, even though that land may have been declared reserved forest under the Act.

7. Mention has been made of certain conditions to which the application of the principle laid down in the preceding paragraph should be subject. They have for their object the utilization of the forest area to the greatest good of the community. In the first

place, the honey-combing of valuable forests by patches of cultivation should not be allowed ; as the only object it can serve is to substitute somewhat better land in patches for sufficiently good land in large blocks, while it renders the proper preservation of the remaining forest area almost impossible. The evil here is greater than the good. In the second place, the cultivation must be permanent. Where the physical conditions are such that the removal of the protection afforded by forest growth must result, after a longer or shorter period, in the sterilization or destruction of the soil, the case falls under the principle discussed in paragraph 4 of this Resolution. So again, a system of shifting cultivation, which denudes a large area of forest growth in order to place a small area under crops, costs more to the community than it is worth, and can only be permitted, under due regulation, where forest tribes depend on it for their sustenance. In the third place, the cultivation in question must not be merely nominal, and an excuse for the creation of pastoral or semi-pastoral villages, which do more harm to the forest than the good they reap from it. And in the fourth place, cultivation must not be allowed so to encroach upon the minimum area of forest which is needed in order to supply the general forest needs of the country, or the reasonable forest requirements, present and prospective, of the neighbourhood in which it is situated. In many tracts cultivation is practically impossible without the assistance of forests, and it must not be allowed to destroy that upon which its existence depends.

8. It has been stated above that the forests under consideration are generally, but not always, free from customs of user. When, as sometimes happens, they are so intermingled with permanent villages and cultivation that customary rights and privileges militate against their management as revenue-paying properties, the principles laid down at the end of paragraph 5 of this Resolution should be observed, and considerations of income should be made secondary to the full satisfaction of local needs. Such restrictions as may be necessary for the preservation of the forest, or for the better enjoyment of its benefits, should be imposed ; but no restriction should be placed upon reasonable local demands, merely in order to increase the State revenues.

9. The third class of forests include those tracts which, though true forests, produce only the inferior sorts of timber or the small growths of the better sorts. In some cases the supply of fuel for manufactures, railways, and like purposes, is of such importance that these forests fall more properly under the second class, and must be mainly managed as commercial undertakings. But the forests now to be considered are those which are useful chiefly as supplying fuel and fodder or grazing for local consumption ; and these must be managed mainly in the interests of the population of the tract which supplies its forest requirements from this source. The first object to be aimed at is to preserve the wood-

and grass from destruction ; for user must not be exercised so as to annihilate its subject, and the people must be protected against their own improvidence. The second object should be to supply the produce of the forests to the greatest advantage and convenience of the people. To these two objects all considerations of revenue should ordinarily be subordinated.

10. It must not be supposed from the preceding remarks that it is the intention of the Government of India to forego all revenue from the large areas that are valuable chiefly for the fuel and fodder which they yield. Cases must be distinguished. Where the areas in question afford the only grazing and the only supply of fuel to villages which lie around or within them, the necessities of the inhabitants of these villages must be treated as paramount, and they should be satisfied at the most moderate rates, and with as little direct official interference as possible. But where the villages of the tract have already ample pasture grounds attached to their cultivation and owned and managed by themselves, and where the Crown lands merely supplement these pastures and afford grazing to a nomad pastoral population, or to the herds that shift from one portion of the country to another with the changes of the season, Government may justly expect to reap a fair income from its property. Even in such cases, however, the convenience and advantage of the graziers should be studiously considered, and the inhabitants of the locality, or those who habitually graze over it, should have a preferential claim at rates materially lower than might be obtained in the open market. It will often be advantageous to fix the grazing demand upon a village or a nomad community for a year or a term of years. The system, like every other, has difficulties that are peculiar to it ; but it reduces the interference of petty officials to the lowest point, and minimizes their opportunities for extortion and oppression. Where grazing fees are levied *per capita*, free passes are often given to a certain number of cattle. In such cases the cattle which are to graze free should include, not only the oxen which are actually employed on the plough, but also a reasonable number of milch cattle and calves. A cow or a buffalo is as much a necessity to a cultivator, using the word necessity in a reasonably wide sense, as is a plough-bullock ; and in many parts, the oxen are bred in the village.

11. In the portions of his report which are referred to in the preamble to this Resolution Dr. Völcker strongly recommends the formation of fuel and fodder preserves, and the Government of India has repeatedly urged the same policy upon local Governments. The question whether any particular area can be made to support a greater number of cattle by preserving the grass and cutting it for fodder, or by permitting grazing upon it, is one that must be decided by the local circumstances of each case. But when it has been decided, the issues are by no means exhausted. It has been stated in paragraph 9 above that one main object

towards which the management of these minor forests should be directed is, the supply of fuel and fodder "to the greatest advantage and convenience of the people." In doing so, due regard must be had to their habits and wishes. It may be that strict preservation and periodical closures, or the total prohibition of grazing, will result in the largest yield both of fuel and of fodder in the form of hay. But that is of small avail if the people will not utilize the increased supply in the form in which it is offered them. The customs of generations alter slowly in India; and though much may and should be done to lead the people to their own profit, yet it must be done gently and gradually, always remembering that their contentment is no less important an object than is their material advantage. It must be remembered, moreover, that the object of excluding grazing from the preserves in question is the advantage of the *neighbourhood*; and that the realization of a larger income than grazing would yield, by preserving the produce, only to sell it to the highest bidder for consumption in large towns at a distance from the preserve, is *not* always in accordance with the policy which the Government of India has inculcated. Here again circumstances must decide. It may be that the local supply of fuel or fodder, independently of the reserved area, is sufficient in ordinary years for the needs of the neighbourhood. In such a case the produce may legitimately be disposed of in such years to the greatest advantage, reserving it for local consumption only when the external supply runs short. Finally, the remarks regarding agency in paragraph 12, and the more general considerations that are discussed below in paragraph 13 of this Resolution, apply in full force to areas thus reserved for the supply of fuel and fodder.

12 The fourth class of forests referred to are pastures and grazing grounds proper, which are usually forests only in name. It is often convenient, indeed, to declare them forests under the Act, in order to obtain a statutory settlement of the rights which the State on the one hand, and private individuals or communities on the other, possess over them. But it by no means follows as a matter of course that these lands should be subjected to any strict system of conservation, or that they should be placed under the management of the Forest Department. The question of agency is purely one of economy and expediency; and the Government of India believe that in some cases where these lands are managed by the Forest Department, the expenditure on establishment exceeds the revenue that is, or at any rate the revenue that ought to be, realized from them.

The following remarks apply, not only to forest lands under the Act, whether administered by the Forest Department or not, but also to all Crown waste, even though not declared to be forest. Here the interests of the local community reach their maximum, while those of the general public are of the slightest nature. It

follows that the principles which have been already laid down for the management of minor forests apply, if possible, with even greater force to the management of grazing areas pure and simple.

13. The difficulties which arise in connection with these areas are apt to present themselves in their most aggravated form where the tenure of land is ryotwari. In zemindari tracts the Crown lands generally assume the second of the two forms indicated in paragraph 10 of this Resolution. But where the settlement is ryotwari, every survey number or field that is unoccupied or unassigned is in the possession and at the disposal of Government, and trespass upon it is *prima facie* forbidden. In some cultivated tracts, these unoccupied and waste lands are the only source available from which the grazing requirements of the resident population can be met. The Government of India are clearly of opinion that the intermixture of plots of Government land which are used for grazing only, but upon which trespass is forbidden, with the cultivation of occupancy or proprietary holders, is apt to lead to extreme abuses, and especially so when these plots are under the management of the Forest Department. The inferior subordinates of the Forest Department are perhaps as reliable as can be expected on the pay which we can afford to give; but their morality is no higher than that of the uneducated classes from which they are drawn; while the enormous areas over which they are scattered and the small number of the controlling staff render effective supervision most difficult. It is not right, in order to protect the grass or the grazing dues on plots of waste scattered over the face of a cultivated district, to put it into the power of an underling to pound or threaten to pound cattle on the plea that they have overstepped the boundary between their owner's field and the next. Still less right is it to permit the exercise of the power of compounding offences allowed by section 67 of the Forest Act, to depend upon the mere report of a subordinate servant, or to expose him to the temptations which such a power holds out. Where the interests involved are sufficiently important, it may perhaps be necessary to accept the danger of extortion while minimizing as far as possible the opportunities for it. But in the case under consideration the interests involved are trifling, while the opportunities are unlimited.

14. It is to be distinctly understood that the Government of India do not desire that grazing should be looked upon primarily as a source of income. But it by no means follows that all revenues from scattered Government lands should be relinquished. It is, indeed, inadvisable that this should be done, as to do so would give the raiyats an interest in opposing allotment and making things unpleasant for new occupants. But the objections to direct management which have just been pointed out are reduced to a minimum or altogether avoided, when the management is placed in hands of the resident cultivators or of representatives

from among them. It will generally be possible to lease or otherwise manage the unoccupied lands of a village through the agency of the community ; not, indeed, at the highest price which they are ready to pay to escape such evils as have just been alluded to, but at a moderate estimate of their value to them, fixed in view of the fact that herds and flocks, which cannot exist without grazing, are often a necessary condition of the successful conduct of that cultivation upon which the Government land-revenue is paid. In no case should fields that have been relinquished be let to outsiders at a reduced assessment for grazing purposes, for then we might have speculators taking up such fields, mainly in order to make what they can out of trespassing cattle.

15. One more point of principle remains to be noticed. The procedure under Chapter IV of the Indian Forest Act, whereby forests are declared to be protected, has been in certain cases regarded by the Government of India as a provisional and intermediate procedure, designed to afford time for consideration and decision, with the object of ultimately constituting so much of the area as it is intended to retain, a reserved forest under Chapter II, and of relinquishing the remainder altogether. The Act provides two distinct procedures. By the more strict one, under Chapter II, existing rights may be either settled, transferred or commuted ; and this procedure will ordinarily be applied to forests of the first and second classes indicated in paragraph 3 of this Resolution. By the second procedure under Chapter IV rights are recorded and regulated ; and this procedure will often be properly followed where the rights to which the area is subject are extensive, and forest is to be managed mainly in the interests of the local community. It will ordinarily be applied to forests of the 3rd and 4th classes. This second procedure may indeed be provisional, and introductory to reservation under Chapter II ; but there is in the Forest Act nothing repugnant to giving it a larger and even a permanent operation. As regards Government, the chief difference between the two procedures is, that new rights may spring up in a protected, but not in a reserved forest, and that the record-of-rights framed under Chapter II is conclusive, while that framed under Chapter IV only carries a presumption of truth. It is believed that this presumption offers ample security where the object of regulating the rights is to provide for their more beneficial exercise, rather than to override them in the public interest. As regards the people, the chief difference is that, speaking broadly, in a reserved forest everything is an offence that is not permitted, while in a protected forest nothing is an offence that is not prohibited. In theory it is possible so to frame the permission and the prohibition as to make the results identical in the two cases ; but in practice it is almost impossible to do so. If it were not so, the distinction drawn by the legislature would be unnecessary and meaningless. It is only where

the public interests involved are of sufficient importance to justify the stricter procedure and the more comprehensive definition of forest offences, that the latter should be adopted.

The Governor-General in Council desires, therefore, that with regard both to fuel and fodder preserves, and to grazing areas pure and simple, and especially to such of them as lie in the midst of cultivated tracts, it may be considered in each case whether it is necessary to class them, or, if already so classed, to retain them as forest areas ; and if this question is decided in the affirmative, whether it would be better to constitute them protected rather than reserved forests.

19. Such are the general principles which the Government of India desire should be observed in the administration of all State forests in British India. They are fully aware that the detailed application of these principles must depend upon an infinite variety of circumstances which will have to be duly weighed in each case by the local authorities, to whose discretion the decision must be left. One of the dangers which it is most difficult to guard against is the fraudulent abuse of concessions for commercial purposes ; and only local considerations can indicate how this can best be met. The Government of India recognize the fact that the easier treatment in the matter of forest produce which his Excellency in Council desires should be extended to the agricultural classes may, especially in case of true forest areas, necessitate more careful supervision in order that the concession may be confined within its legitimate limits. But, on the other hand, they think that, in some Provinces, it will render possible a considerable reduction of existing establishment ; and they desire that this matter be carefully considered with reference to what has been said above in paragraph 12. They know also that in some Provinces forest policy is already framed on the lines which they wish to see followed in all. But the Governor-General in Council believes that local Governments and Administrations will be glad to receive the assurance now given them, that the Supreme Government will cordially support them in recognizing and providing for local requirements to the utmost point that is consistent with Imperial interests. Where working-plans or plans of operation are framed for forests, the provisions necessary for this purpose should be embodied in them. The exercise of the rights that have been recorded at settlements will necessarily be provided for in these plans. Where further concessions are made by way of privilege and grace, it will be well to grant them for some such limited period as ten years, so that they may, if necessary, be revised from time to time, as the circumstances on which they were moulded change.—(*Gazette of India.*)

(We have printed this long Resolution in full as we believe many of our subscribers, especially those in Europe, may wish to see it. Any remarks we may have to make are deferred to a later number.) (HON. ED.)

IV.—REVIEWS.

Annual Forest Administration Report for 1892-93 for
Bengal, the Punjab and Coorg.

The BENGAL Report is an interesting one for those who are personally acquainted with the forests, but there is not much in its record of hard work, which can be specially referred to or quoted as of special interest. After reading such statements as that of the Director of Agriculture in the Central Provinces, referred to in our last month's number, it is very satisfactory to note the good relations which exist in Bengal between Revenue and Forest officers. The Conservator says :—

“ There was an absolute absence of friction between Divisional and District officers, and between this department and other departments. In every instance do the District officers appear to have looked upon the forest administration of the country as a part of their own duty, and to have afforded their professional forest assistants all the aid in their power. This interest taken in forest questions by the District officers, and their appreciation of the relative degree of responsibility attaching to themselves and their forest assistants in the efficient management of the State forests, is one of the pleasantest features of forest administration in Bengal.”

Of course, it was only what was to be expected, for an interest in the Department on the part of Lieutenant-Governors and Revenue officers of all grades is traditional in Bengal ; though, perhaps, something may also be set down to the fact that most of the forest areas are in out-of-the-way localities, and not mixed up with the agricultural country as they are in parts of Central, Southern and Western India. The main districts of Bengal and Behar are, of course, under the Permanent Settlement, and consequently the Department has nothing to do with them. As usual, the most interesting matter to our readers are to be found in the portion of the Report which deals with reproduction. The remarks on reproduction in the Sundarbans have been thought worthy of quotation in the Local Government Review, and we give them also :—

“ In the Sundarbans forests conditions are so favourable to vegetation that we note without wonder the account which the Divisional Officer gives of a new island, three miles long, that

‘ appeared above the waters of the Pancassia river in 1891, having
 ‘ by this time covered over to a great extent with bushes fifteen
 ‘ feet high of Keora (*Sonneratia apetala*), Ora (*Sonneratia acida*),
 ‘ Bain (*Avicennia officinalis*), a few seedlings of Golpatta (*Nipa*
 ‘ *fruticans*), and quantities of wild rice (*Oryza sativa*).

‘ Reproduction of tree growth in the Sundarbans forests is,
 ‘ indeed, a curious sight to see. Seedlings of Gengwa (*Excoecaria*
 ‘ *Agallocha*) may be perceived on the shelving banks of the rivers
 ‘ coming up as thickly as the best crops of paddy. The majority
 ‘ of the species shed their seed during the rains, and this seed is
 ‘ then floated by the tides—which attain their highest level at that
 ‘ season of the year—in immense quantities (and often in a state
 ‘ of germination as they float along) well into the interior of the
 ‘ innumerable islets which go to form this singular region.”
 and the Conservator’s remarks upon Angul are also most
 interesting, for these beautiful sal forests of Orissa are, like those
 of Ganjam further south, quite different in character to much of
 what is found in the Sub-Himalayan region :—

“ The splendid sal reproduction to be seen in those beautiful
 ‘ forests of Angul that stretch along the Mahanadi river surprised
 ‘ the Inspector-General of Forests himself, and it is a pity that the
 ‘ absence of a market for the excessive proportion of inferior
 ‘ species found in these forests should not enable us to foster, as
 ‘ we would wish, the evident bent of the sal in this locality to
 ‘ extend itself over the whole of the Tikarpara-Bagmunda Range.
 ‘ We should like to cut away or girdle the trees that oppose their
 ‘ heavy cover to the spread of the more valuable sal, but the small
 ‘ demand for the produce and the danger of accumulating inflam-
 ‘ mable rubbish on the ground give us but small latitude in the
 ‘ matter.”

The Conservator, Mr. Dansey, complains feelingly of the
 difficulties he has to contend with in a huge Circle with an insuffi-
 cient staff, and he instances the fact that the Chittagong Division
 changed hands no less than seven times during the 15 months, and
 three times directly afterwards, making 10 changes in 18 months.

The financial results of the year were :—

	Forest year, 15 months.	Financial year.
Receipts	... 9,04,803	7,44,882
Charges	... 4,74,586	3,81,608
Surplus	... 4,30,217	3,63,274

both gross and net revenue being only a little less than in the
 previous year.

The PUNJAB Report has been a melancholy one to read. All
 through it shows the characteristic opinions and style of its writer,
 Mr. R. H. C. Whittall, whose sudden death the Government of

India have referred to with regret. It is besides, as the Government of India have also remarked, an interesting Report, clearly showing the state of affairs as regards forest conservancy in the Punjab at the present time.

The area of forest, at the end of the year, contained the following :—

			sq. miles.
Reserved	(1)	Departmental	... 1,634
	(2)	Military	... 42
	(3)	District	... 70
Protected	(1)	Departmental	... 67
	(2)	District	... 131
Unclassed	...	...	... 5,670
Total			.. 7,614

there having been a slight decrease during the year owing to the giving up of areas for cultivation along the Chenab canal line. The Report gives a formidable list of areas for which Working Plans are needed, and most especially instances Kulu and Kaghan as being British tracts and requiring the present employment of capital more than their neighbours, the Leased Forests. In regard to the Working Plans for the 'rakh' lands of Multan and Montgomery the Conservator says :—

"Next in order of importance come the areas which feed the North-Western Railway with fuel ; these are in Montgomery, 240 square miles, and in Multan about 70. The Reserved forests are not of sufficient extent to maintain the supply, and Government have hitherto shown themselves unwilling to extend reservation. So that if Working Plans are made they must embrace tracts of unclassified forests where the rights are unknown and unrecorded, and where the grazing restrictions are not likely to fulfil forest requirements.

"In these rakhs no very scientific forestry is required. Local Dehra-trained Rangers can, under proper check, do the field work ; the only difficulty is the grazing and the fitting of it in with the cuttings, and I fear that unless the grazing restrictions during the time young forest is growing up are made more rigid, it will be impossible to include areas of unclassified forest in the Working Plans. The subject is receiving local attention. In Multan many forests have been described compartment by compartment, the rotation decided upon, and the sequence of fellings, while we hope that an increase to the reserved area may be permitted. In Montgomery, the area necessary to supply the railway, about 240 square miles, has been roughly mapped, divided into large blocks and estimated, and the question is being considered whether the restrictions to grazing granted by Sir James Lyall in 1889 over the unclassified portion of about a lakh

‘ of acres will permit of a regular programme of working being
‘ adopted.”

In regard to the natural reproduction the report has much of interest in respect to the silviculture of deodar, blue pine, spruce and silver fir, so we need not offer apologies for making a lengthy extract :—

“HAZARA.—Mr. Gisborne Smith reports that natural reproduction of silver fir is not so deficient as has generally been supposed. It is worst on the higher and moister slopes where dense undergrowth prevails. In a few selected places, a certain amount of grazing, under strict regulation has been permitted, as the cheapest way of keeping down this undergrowth. In Kaghan natural reproduction of deodar is good, especially where light grazing takes place.

‘ RAWALPINDI.—The absence of fires for now three successive years has had a most marked effect on the vegetation in the Murree and Kabuta hills. And Mr. Forrest also states that the damage from grazing is not so great as is generally supposed, because in these hills the grazing is, as yet, light.

‘ CHAMBA.—All that Mr. MacIntire has to say on this subject is always interesting, and I agree with him that light grazing to keep down the rank herbaceous growth, which is the greatest enemy the young deodar seedling has, is not only permissible but necessary. Grazing of kine on steep hill slopes can never be heavy as it is in the plains where animals herd together ; and when the numbers and the seasons of admittance can be regulated, grazing may often be permitted, in the hills only, where we have been in the habit of rigorously excluding it. It was noticed that the ground near seed-bearers, the seed being plentiful, was often more covered with seedlings when the soil had not been wounded or terraced than where these works had been undertaken. This seems to point to the abandonment of the idea of preparing the soil for the reception of naturally deposited seed. I quote the following from the Divisional Report as well worthy of attention.

“ But no practical plan of saving such seedlings from destruction, such as has overtaken nearly all germinating in previous years, has been thought out. It has been noticed that shade does not seem to hinder the germination of such seedlings whatever its results may be as they grow older. And as most, or nearly all, of the seedlings are well rooted in the soil, it is difficult to believe they die out mainly because they germinate among dead leaves and vegetable humus, which are usually far from covering up the soil to any considerable depth. Also, as the death-rate from drought in deodar nurseries sown in exposed places is generally small, it cannot be supposed that drought is the principal obstacle to their establishment. There seems to be no way out of supposing that the principal reason why so few deodar seedlings establish

‘ themselves is that in most situations they are at first incapable of fighting other forms of vegetation which are produced.’

‘ In the Kalatop Forest, the seedlings of spruce and silver fir on the contrary, at ordinary elevations seem capable of establishing themselves amongst and growing through other vegetation.

‘ This is just what the silver fir in the Dungagaili Range of Hazara does not appear able to do.

‘ KANGRA.—In Kangra, natural reproduction has been materially improved in the Chil and bamboo forests by the removal of dense undergrowth, and in the bamboo forests by the exclusion of grazing during the three rainy months.

‘ KULU.—In Kulu, the deodar seeded profusely, and owing to favourable climatic reasons the show of natural seedlings is said to be magnificent, in places whole nurseries of self-sown deodar having been formed. The Divisional Officer still complains of the excessive grazing by sheep and goats.

‘ BASHAHR.—The report from Bashahr is also interesting and the rapid spread of the blue pine forming pure forest over formerly treeless tracts is remarked on at length. Mr. Minniken also notices what has been frequently observed on previous occasions in Chamba, viz., that where the deodar in a mixed forest is rare, there is little hope of perpetuating it. This is especially the case in cold and moist situations where rank vegetation prevails, and is the reason why we are very cautiously admitting a little grazing in such places. Pure forests of blue pine also are peculiarly liable to injury and even destruction by insect pests, and the artificial intermixture of deodar with this pine would be a very good measure.”

In our May number, at page 178, we inserted a note asking for information about what became of the quantities of seed of *Albizzia lophantha* which have been obtained from Australia for the Punjab Forest Department. The following extract practically gives the answer to our enquiries, and we hope it will shew Baron von Mueller that the seed has not been wasted :—

“ By far the most interesting and perhaps the most important experiment is that with the European *Robinia Pseudo-Acacia* and Australian *Albizzia lophantha*. I have previously explained that I did not particularly care to spend much money or trouble on the introduction of these species in the higher hills, although they are being supplied to those places in small quantities. But I am very desirous of finding some species which will assist us in stocking up our forests in the low hills up to 4,000 feet. Previous experiments had been decidedly unsatisfactory in results, but I was convinced that the plants had, in most places where they had been tried, not received fair play.

‘ Proper trouble was not taken to cultivate them, and the nursery treatment was certainly neglected. In the situations I particularly desired success, nothing was done beyond sowing the

‘seed in indifferently prepared nurseries and then abandoning it.
 ‘For this year, however, I am glad to report a very decided improvement both in the interest and care taken, and in the result.

‘In the Pabbi I found last January a few plants still alive in the nursery in which they had been sown in the previous rains: they had never been re-bedded or cared for in the least, and consequently had very long tap roots. The weather being favourable I had them re-bedded at once before me, only 3 out of 400 *Robinias* and 20 out of 706 *Albizzias* succumbing under the operation. They made such progress in the new beds that at the end of February they again required re-bedding; unfortunately my orders had again been neglected, they had been steadily watered when they did not require water, and were far too delicate for forest plants and their numbers fell to 340 and 500. These are now all alive and well; and, notwithstanding mistakes, I am convinced that the nursery treatment of the two species, especially of the *Robinia*, is perfectly easy. The *Robinia* grows much faster than the *Albizzia*, and in June 1893 had reached the dimensions I had fixed for its being transplanted out. They were put out in pits 15 feet apart, and have now made remarkable progress in their final homes. All the 340 are alive and well. I consider these results very promising for the extension and success of the *Robinia* in the Pabbi.”

The financial results of the year were as follows :—

	Forest year 12 months.	Financial year.
Receipts	... 8,20,988	8,12,632
Charges	... 6,52,044	6,56,265
Surplus	... 1,68,944	1,56,367

the results being very low. The Conservator remarks that the revenue will probably decrease, so that the surplus cannot be maintained in future; but in this the Government of India disagree.

The COORG Report has suffered in interest from the fact that the Deputy Conservator, Mr. G. H. Foster, died during April, 1893, and his successor did not join till after the close of the year. The chief subject discussed in it as well as in the Reviews by the Commissioner of Coorg and the Chief Commissioner is the improvement of fire protection works in which the late Mr. Foster took such an interest.

The financial results of the year were :—

	Forest year.	Financial year.
Receipts	.. 1,85,529	1,80,676
Charges	... 70,407	73,091
Surplus	.. 1,15,122	1,07,585

Durability of Wooden Sleepers.

The last statement published by the Public Works Department shows the results of the experiments to test the durability of wooden railway sleepers up to the end of the year 1892.

On the Ajmere-Khandwa section of the Rajputana-Malwa Railway six miles of wooden sleepers were laid down in 1876. The results at the end of the year 1892, *viz.*, after 16 years, are as follows :—

Out of	2,054	Deodar	95	per cent.	are still sound
„	6,585	Creosoted Pine	33	„	„
„	1,986	Kahoo	32	„	„
		(Terminalia Arjuna)			
„	83	Sal	33	„	„
„	902	Anjan	41	„	„
„	689	Teak	29	„	„

On another section of this line, out of 13,042 creosoted pine sleepers laid down in 1880 only about 20 per cent. are still sound, and out of 450 deodar on the same section only 29 per cent. On the Rewari-Ferozapore section, of 1,166 deodar laid down in 1882, 68 per cent. are still sound, whereas of a small number of creosoted pine, 84 per cent. were removed after four years.

Again, in another part of the same section, out of 11,943 deodar laid down in 1884 only 74 have so far been removed, but the time is rather short for this result to be of much value.

On the North-Western Railway, out of 1,416 deodar laid down in 1877, 79 per cent. are still sound, after 15 years, whereas of 1,144 creosoted pine of the same experiment none now remain, the average age of this kind of sleeper at the time of removal being 13 years.

The results obtained on this Railway are, however, a little variable, as in another portion 957 Deodar sleepers laid down in 1878 were all removed in 13 years, whereas the creosoted pine seems to have fared better, as out of 382 only 193 had to be removed after 14 years ; the number of the latter in this case, however, is rather too small to affect the general results of the experiments which still remain as heretofore in favour of deodar.

On the Southern Mahratta Railway out of a small number of teak and creosoted pine laid down in 1880, 93 per cent. of the former and 60 per cent. of the latter are still sound. In another part of the same line out of 1,020 teak and 589 pine (creosoted) 91 per cent. and 55 per cent. respectively are still sound after 12 years.

On the Eastern Bengal Railway, in the experiment of 1877, out of 1,973 Sal, 59 per cent. are still sound, whereas of 1,923 creosoted pine only 9 per cent. still remain.

In another portion of the same line, Sal shows 73 per cent. still sound out of 2,006 laid down in 1879.

The other experiments on this line extend over shorter periods, but it may be noted that 57 of the 1,823 iron-wood sleepers laid down in 1884 had to be removed during the year 1892.

A. F. G.

Athletic Sports of the Imperial Forest School.

On Saturday last, the 13th of October, the annual sports of the Imperial Forest School came off on the Old Parade-ground. The Director of the School, Mr. J. S. Gamble, had, unfortunately, to go out into camp the week before, and so was unable to superintend the sports as has been his wont for the last three years. The course was laid out very prettily with flags by the school staff under the superintendence of the Deputy Director, Mr. Nisbet. The committee was composed of the school staff, the Forest Divisional Officers in Dehra and Mr. Reynolds, Superintendent of the Forest Surveys. The view from the Parade-ground, commanding as it does a complete panorama of Mussoorie, is always beautiful, and when the visitors arrived, as the evening drew on, the bold range of hills on which that favoured hill station rests formed a peculiarly suitable background to the Parade-ground and the line of well-wooded estates which bounds it on the northern side.

Tents were erected as usual for the reception of visitors, and a detachment of Municipal Police kept the enclosure which had been roped off around the tents free from the usual crowd who invariably collect when a *tamasha* of any kind takes place. The preliminary heats were run off early in the afternoon, and the finals of the different contests came off later when more spectators had arrived. Another year, it is probable that the heats will be run off during the previous week, and that the final contests only will be reserved for the day. This would be a decided improvement. The event of the afternoon was the performance of P. E. Plunkett in throwing the cricket ball; we think that the throw is a record for Northern India, if not for the whole of India. The ball was thrown against a light and somewhat variable wind, and the distance was accurately measured under the direct

supervision of the committee. The distance thrown was 116 yards, 1 foot. None of the other performances call for special mention, the entries were not so numerous as usual, probably owing to a few of the students being decidedly better than the others. The half mile was a good race, and brought out fourteen competitors, the contest for the high jump was very keen. The list of winners is appended. No times were taken :—

100 Yards' Flat Race. (Open)

F. J. Langhorne	...	...	1
N. Chinniah	...	...	2
S. A. Wood	...	...	3

There were fourteen entries, but only seven men actually started, the race resulting in an easy win for Langhorne. Chinniah and Wood had a good tussle for second place.

Broad Jump. Open to the whole school. One prize for the best native student. 11 entries.

F. J. Langhorne, 16 ft. 7 in.

Best Native Student: N. Chinniah, 15 ft. 6 in.

Won easily, the winner was not at all pressed, or would have undoubtedly jumped better.

Hurdle Race—120 yards. Open to the whole school. 12 entries.

This race was run off in two heats, the first and second man in each heat running in the final.

F. J. Langhorne	...	...	1
S. A. Wood	...	...	2

Langhorne drew away at the first hurdle, and won by 10 yards. Chinniah, who had been running in a great many events, pressed Wood as far as the eighth hurdle, when the latter drew away and came in second.

Hurdle Race for Native Students only. 7 entries.

This was run off in two heats, the first two men in each heat running in the final. The results of both the heats were very close, and in the final a very good race resulted in favour of Kashi Ram.

Kashi Ram	...	...	1
N. Chinniah	...	...	2

Both men took the hurdles simultaneously, the winner drew away after the last hurdle and won by a yard.

Throwing the Cricket Ball. Open to the whole school. One prize for the best native student. 7 entries.

P. E. Plunkett, 116 yards, 1 foot.

Best native student; N. Chinniah, 87 yards 1 foot.

A magnificent throw ; W. Brewin, who was second, threw 93 yards, 1 foot.

100 Yards' Flat Race for Native Students only. 12 entries.

This was run off in two heats, the first two in each heat running in the final.

N. Chinniah	...	...	1
Amar Nath	...	...	2

A very close race, won by 1 foot.

High Jump. Open to the whole school. One prize for the best native student. 8 entries.

S. A. Wood, 5 ft., 1 in.

Best native student : Kashi Ram 4 ft., 8 in.

Graham, who was second, cleared 5 ft., but failed to jump 5 ft. 1 in.

100 Yards' Flat Race for Forest Chaprassis.

Amar Sing	...	...	1
Burhan-u-din	...	...	2
Pir Mahomed	...	...	3

Half Mile. Open to the whole school. 14 entries.

R. C. Farrell	...	...	1
Daya Ram.	...	...	2

Daya Ram followed by Kashi Ram forced the pace to begin with, and at half distance they were leading by 30 yards, the European students lying in a bunch behind. About 200 yards from home Farrell increased his pace and soon passed Kashi Ram, and about 80 yards from home caught Daya Ram and won a good race by 15 yards.

100 Yards' Flat Race for Gurkha Riflemen. 8 entries.

This was run in two heats and resulted as shown below :—

Tikaram Kuar	..	...	1
Nathu	...	...	2
Naik Parbal Gutung	...	...	3

The Tug-of-war brought the contests to a conclusion. The sides were Seniors vs. Juniors, and resulted in an easy win for the Seniors, which they ascribed to the muscle-forming properties of the hill tour made annually in the Jaunsar Forest Division in the hot weather. The prizes were distributed by Mrs. Garstin at 6 P. M., the names of the winners being called out by the Deputy Director. Plunkett, Langhorne, Chinniah and Pir Mahomed came in for the greatest share of applause. Cheers were then given for Mrs. Garstin, the ladies, the Deputy Director, and the Instructors ; and then the proceedings terminated. The chief brunt of the work in the actual laying out of the course fell on Forest Ranger Birbal and his assistants, and he proved himself quite equal to the task.—(*Pioneer*).

VI.—EXTRACTS, NOTES AND QUERIES.

Woods used in India for the Construction of
beer-barrels.

We have received the following extract from the Inspector-General of Forests :—Before proceeding to discuss the trade in beers and ales, it is necessary to say something about the construction of beer-barrels, etc. The barrels or casks used in the breweries of this country are almost without exception constructed of oak, and are either made up in India from rough staves imported from the Baltic, or imported in shooks, *i.e.*, bundles from London, and re-made in this country. Several attempts have been made to utilise the indigenous timbers of this country for barrel-making, but the extensive and various forests of India have failed up to the present moment in producing a wood good enough to replace the English or European oak. Sal (*Shorea robusta*) has been tried with some success in the construction of vats. White cedar from the Malabar Coast makes a good looking vat, but its use is somewhat dangerous in consequence of the absorbent nature of the wood rendering it very liable to crust. The English oak would find a strong competition in the Indian ash and teak if the former could be got in larger quantity and the latter at cheaper rates. Deodar, and the wood of pines generally impart their resinous properties to the beer. The brewers of India are very anxious to find a wood which would successfully compete with the expensive and indispensable English oak, but hitherto the efforts to find such a timber have been unsuccessful. The valuable characteristics of oak are its freedom from knots, its density, durability and lightness. It is also non-absorbent, and thus not liable to impart its resin to the beer.

In some experiments tried with the wood of various oaks, as materials for beer-barrels, Messrs. E. Dyer & Co., of the Burma Brewery, found casks made from two varieties (*Quercus glauca* and *Quercus serrata*) useless, as the wood was too porous and the beer oozed. A third species (*Quercus semiserrata*) is reported to have good, straight-grained wood, free of knots, very nearly resembling imported oak, and the casks made out of it retained the beer well. Unfortunately the difficulties in the way of the transport render its price prohibitive. But if the economic value of the tree comes to be known, and its cultivation on a wide scale is undertaken in suitable localities, the gradual extension and improvement of internal communications may in time bring the wood into the market.

Quercus semiserrata (*thitkya*, Burma,) is an evergreen tree, found on the plains of Assam and Cachar and on the Garo and Khasia Hills, up an elevation of 3,000 feet. It occurs also in Burma from Pegu to Tenasserim.—(*Indian Agriculturist*, October 1st, 1894.)

On the Utilisation of Waste Produce of Forest and Woodlands.

The successful culture of forest trees is a matter of much importance to landed proprietors, although at the same time it is very important to be able to turn the trees to the best account after they have attained the years of maturity, so that root, stem, and branch may be utilised to the best advantage and nothing lost. Tree roots are often left in the ground to rot, but I have found the roots of many species capable of being turned to account for profit in several ways. The roots of the larch, elm and spruce when of proper size and shape, are valuable for making knees, for boat-building and other purposes in rural economy; the price varies considerably according to size, shape, and quality, but as a general rule I have found them realize more than double the price of the wood of the stem. The most expeditious way of extracting and preparing them in the forest is to cut the roots at the proper distance from the base of the stem, than, by attaching a rope to the top of the tree, and taking advantage of the leverage of the stem, the tree can be pulled down and the roots torn up at a trifling cost in comparison with that of felling the tree first and then grubbing up the root after. The stem of the tree should then be cut off with a saw, about 18 in. or 2 ft. from the base of the root, in order to form the shape of the knee. I have used the small surface roots of the common spruce and birch for weaving rough baskets, creels, and hampers; the best roots for this purpose are generally to be found in mossy ground, where they run along the surface and are often of great length, fine in texture, and easily extracted. In some soils and situations the roots of the common ash and hazel can be turned to good account by the cabinet-maker and others for veneering and fancy work of different kinds. The roots of both species often exhibit great variety in texture and colour; sometimes they become stained of a blackish hue mixed with red, and as they both take on a fine polish, they are considered by some to be little inferior to that of ebony. Although the roots of the fir tribe of trees are often left in the ground to rot and decay, yet they are capable of being utilised for firewood; I have found the roots of the Scotch Fir to be the best for this purpose, as the fibrous texture of the roots is generally pretty well impregnated with resin, which enhances their value very much in kindling fire. When the roots are dug up they are cut with an axe into fragments of about 11 in. in length; they are then tied into bundles of from 8 to 10 in. in diameter and sold at the rate of one penny, and sometimes two-pence, per bundle. In some parts of the country there are parties who make a trade of preparing firewood in this way, and

thus act the part of a middleman between the landlord and consumer. These middlemen occasionally pay so much for the privilege of extracting the roots, while at other times they get them free of charge, as the landlord in many cases looks upon it as an advantage in his favour to get rid of the roots as a preliminary step in preparing the ground for replanting. It should be explained here that these roots and stumps when left in the ground are used by the pine beetle and pine weevil for breeding purposes, hence the proprietor's advantage in getting rid of them. Dead trees and fir wood that cannot be used for any better purpose are often sold to these middlemen, who cut and split them up into small pieces some 6 or 8 in. long, tie them into bundles about 6 in. in diameter and sell them at one halfpenny each or three for a penny. Of late, however, a new market has sprung up in this country for wood of young growth and inferior quality for the making of paper. The wood of whatever species of tree must all be white in colour, red heartwood is unsuitable and is not used, which is so far in favour of the vendor as it can generally be utilised in many ways to better advantage. In preparing the wood for this purpose, the outer and inner bark or skin has to be removed, and the wood cut into lengths of from 3 to 6 ft. In a letter of inquiry which I have just received, the writer says: "I can take any quantity you can supply up to 20,000 tons at 20s. per ton, delivered at Barrow." The bark can be removed from the wood with great facility in early summer and when birch, larch, Spanish chestnut, and oak are used, the bark had better be dried in a careful manner, and sold to the best advantage for tanning purposes. The price of these barks varies considerably in different years, according to supply, demand, and quality. The lowest price which I have received for larch bark was 25s. per ton, and the highest for that of oak, which of late years averaged from four to six pounds per ton. The bark, chips of wood, young growth of other species of trees that cannot be utilised for other purposes, should be used for fuel, or converted into manure by burning, when the ashes can then be used for top-dressing grass lawns and other purposes. Wood ashes contain all the required elements of plant-nutrition except nitrogen. 100 lbs. of potash, $3\frac{1}{4}$ lbs. of soda, 67 lbs. of lime and magnesia, and $5\frac{1}{4}$ lbs. of phosphoric acid. When used to improve exhausted soil in fruit-tree culture, wood ashes has no equal, at any rate the writer has used it for many years with the most happy results, as it never produces canker or any other disease at the roots, and improves the growth and health of the trees immensely. The common birch is not considered by many to be a very profitable tree, yet it has some peculiar merits which should not be overlooked. In the first place it not only grows, but also reproduces itself on cold, boggy ground in wet, hollow places, as well as on poor, hard, inorganic matter among the chinks and fissures of rock

on bare, exposed situations where few other trees will grow or attain anything like the size of useful timber. When thinning natural plantations of this class I sold the thinnings at the rate of 12s. 6d. per ton. All shapes and sizes were taken, from branches half-inch in diameter up to any size, and where possible, the bark was used for tanning purposes. Then, if we deduct 1s. 6d. per ton for cutting and preparing the wood, and 1s. per ton for cartage to the depôt, we have a net balance of 10s. per ton in favour of the proprietor for his timber. The charge made of 1s. 6d. per ton likewise covers the expense of thinning. The top branches and twigs were utilised for making besoms, thatching shelter-sheds for cattle, erecting screen and shelter fences, and for fuel. In many parts of the Highlands of Scotland, as well as some parts of Ireland, the birch is looked upon as the husbandman's tree; the wood is used for the making of all kinds of agricultural implements, as well as household furniture, and the roots and branches for fuel and other purposes, so that every part of the tree is turned to good account. In some parts of the country the wood is likewise used for smoking fish and lams, as it is considered to impart an agreeable flavor which is relished and esteemed by many. The bark of the birch often commands a ready sale among fishermen, and when it can be had is preferred before that of any other tree for tanning their nets and cordage, as it is not only lasting, but also imparts a soft elastic finish to the fibre of the cordage, which is considered an advantage. When the bark is well saved it often realises £5 per ton, or more, according to quality. The common alder is another hardy, thrifty tree that can be turned to good account. It grows and attains a profitable size of timber on wet, marshy ground that cannot be thoroughly drained, and when cutting down the trees in such situations the writer sold all shapes and sizes of the wood from 6 in. in diameter and upwards at 20s. per ton, and sizes from 6 in. to 3½ in. in diameter at 8s. per ton, the purchaser to take delivery at his own expense. The branches and twigs were sold at 1s. per load, buyers to collect and remove the stuff at their own expense. These were used for firewood and shelter-fences about farms and other places. This tree is not planted to the extent which its merits deserve, at any rate the writer could never supply the wood to meet all demands at the the above prices, which he found on the whole to be very remunerative. The tree is very tenacious of life, and of rapid growth; the roots left in the ground produce suckers, which form excellent coppice-wood, which after a growth of about eight years, can be profitably cut for making hurdles, crets, &c.; while the young twigs and catkins gathered and prepared in spring produce an excellent dye, the latter of a greenish, and the former of a light brown colour.

The top and lop of the willow and poplar tribe of trees being of a soft, white colour is adapted for paper-making and many other purposes in rural economy where extreme lightness is requisite. Branches of a suitable size are made into sheep-hurdles,

while small flexible twigs can be used for making rough creels and hampers. In some parts of the country the branches are also used in the formation of shelter fences, by planting them about 18 in. deep in the ground, and some 10 or 12 in. apart.

Here they soon emit roots, and by a little care and attention in training and pruning the young growth, a substantial, lasting fence can be formed at a trifling cost. I have also found the branches capable of being used as piles along the banks of rivers to form a bulwark to prevent the water during a spate from encroaching and washing away the earth along the margin. The seeds of the aspen poplar (*P. tremula*) are often spread by the wind throughout plantations, where they vegetate and form young growth among hardy natural grasses and other plants that are capable of being utilised for making hay. When such is the case, my practice has been to cut the whole together and have it properly dried, when it is then built into a stack, mixing a little salt with the stuff as the work of building proceeds, by which means I found the poplar shoots to be eaten during winter with avidity by sheep, cattle, horse, and deer, so that in this respect it has proved to be a valuable forage plant. In many parts of Scotland, England, and Ireland the trees and surface of the ground are to a considerable extent clad with ivy, and, as it is one of the best forage plants with which the writer is acquainted, it is astonishing that it has not been utilised to a larger extent for feeding purposes. Many years ago I observed that sheep and deer preferred ivy to turnips or grass, from which circumstance my practice has been to utilise all ivy thinnings and clippings, as well as that attached to trees, for feeding these animals occasionally when it could be had during winter. They eat the leaves and bark of the stems with such a relish that I believe it to be a wholesome, nutritious tonic.

When thinning young Scotch fir plantations I have occasionally turned the branches and young growth to good account for feeding hares, rabbits, and deer in the vicinity of newly-planted plantations of hard frost and snow. Such plantations often suffer serious damage by these vermin peeling the stems and cutting over the top growth of the plants. Under such conditions my plan has been to cart a quantity of these green branches and have them spread out on the surface of the ground here and there around the margin of the plantation, where they immediately attracted the attention of the animals, who delight to eat the leaves, twigs, and bark at this particular season of the year. The branches of the ash, oak, holly, and laburnum, when they can be had, may also be utilised with advantage for the same purpose. By this means the animals are provided with food more to their liking than the young plants, and if the supply is kept up until such time as the storm breaks up, the damage to a large extent is past, and the plants safe.

These peeled branches can then be sold for firewood, and sometimes for the making of fancy rustic work, and realise about 1s. per load, and occasionally more, according to quality. Scotch fir branches, however, of young growth, are often wanted for rustic work with the bark attached, and in this case I have made the purchaser collect and remove the stuff from the plantations at his own expense, charging him at the same rate per load as the former. In some parts of the country where coals are scarce and dear the top and lop of Scotch fir and other trees can be utilised with advantage for fuel. As, for example, during the time that the new Castle was building at Balmoral, which covered a period of fully six years, from 1853 till 1859, the writer supplied the tradesmen's bothies, about 20 in number, with fir branches for firing, and as coals were often as high in price as 25s and 30s. per ton, the saving effected here was considerable. Another important advantage in this case was that the forest was kept clean and tidy at a trifling cost. All twigs and stuff of small size were collected and burned on the spot, the ashes spread out upon the surface, and the bare spots occasioned by the fires sown with a mixture of hardy grass-seeds suitable for such situations, which soon covered the surface with nutritious grass which proved valuable as pasture for deer and cattle. By this system of management everything was turned to good account; and besides, by the removal of dead wood and branches, which harbour insect pests destructive to pinetree growth, their numbers were kept within bounds to such an extent that very little damage was done to the healthy development of the trees. In some of the extensive peat-bogs in Ireland and other places fir branches have been used to a pretty large extent in the formation of roads. The branches are laid in a regular, uniform manner on the surface of the bog as a base for harder material, and from the well-known antiseptic properties of peat the wood is kept for an indefinite length of time almost in a perfect state of preservation. In the course of carrying out estate improvements the writer has used the branches for this purpose extensively, and found them to be quite free of rot after being underground for a period of thirty years. The cones of many of the coniferous tribe of trees are often allowed to go to waste for want of a little care and attention on the part of the cultivator, whereas by a little painstaking they may be turned to good account as a source of profit. The cones of the native Scotch fir in particular should be collected in the natural forest, and the seed for raising young plants, as the trees are not only harder, but the wood of superior quality to that of trees of the same species raised from seeds of the foreign origin. On the other hand, the cones of the larch had better be collected in Ireland, where the trees are never affected with blotch, ulceration, or blister. Coniferous trees of recent introduction make remarkable progress in that country, and are generally very prolific in the production of seed.

In the year 1861-62 the writer sold cones of *Picea Nobilis* at one guinea each. Of course the cones were carefully impregnated with male pollen to ensure the fertility of the seed. This important branch of arboriculture is both interesting and instructive, and shows what can be done in utilising the seed for the raising of young trees as a source of ornament, profit, and utility.

Although the seed of many species of deciduous trees are often allowed to fall to the ground or be blown away by the wind and lost, yet, in many cases, when they are thoroughly matured in autumn, they can with a little care and attention be utilised for the raising of young plants, and some few species, such as the beech, oak and chestnut, produce fruit that is relished by pigs, sheep, and deer, while the fruit of the walnut is relished by many people as a nutritious article of diet. The top branches of hardwood trees, when of suitable size and shape, are often in demand for pea-stakes and the formation of rustic fences, and are often sold at rates ranging from 2s. 6d. to 5s. per load, according to quality and the cost of transit. Peeled oak branches, however, that can be used for building rustic bridges, seats, and various shapes and forms of ornamental fences and fancy work, realise a higher price than that indicated. The inferior timber of beech trees is used for smoking different species of fish, and such pieces as are free of rot or other blemish are extensively used for making toys, stocks for carpenters' tools, and a variety of other purposes where cheap timber is used. Beech and hornbeam timber are both esteemed in particular for firewood, and the charcoal produced from the wood of both species is considered to be of a very superior quality. In working up the top branches of hardwood trees to the best advantage all pieces that are pretty straight and $3\frac{1}{2}$ inches in diameter can be sold for mining purposes at rates ranging from 7s. 6d. to 10s. per ton, purchaser to take delivery at his own expense. The tops of hardwood as well as fir trees can often be turned to good account for fencing-posts. Sometimes they are in demand in the round state, but very often are wanted cut to the following dimensions:— $6' \times 7" \times 3"$, or $6' \times 6" \times 4"$; when prepared in this way I generally sold them at 10d. per cubic foot, which gave a favourable and profitable return to the proprietor. The same class of timber can often be utilised for half-tree-rafters for roofing sheds. These are prepared by cutting off a slab along the side of the piece, then by turning it over to rest on the flat side thus prepared, it is cut with the saw right along the centre into two halves, so that each piece of timber forms a pair of rafters—hence the name of half-tree-rafters. Small pieces of oak, elm, ash, and sycamore may likewise be cut into staves and headings for casks, and are generally in demand $\frac{3}{4}$ -inch thick, and the length according to specification. Concrete frames are occasionally wanted by builders 18 inches long and 1 inch square. I have generally cut these from fragments of Scotch and spruce fir trees.

In cutting up wood at saw-mills it is a matter of much importance on the score of thrift and economy to use thin saws. Wood merchants who try to make the most of the wood are so well aware of the utility of using thin saws that they seldom use them thicker than No. 14 and 15 by the wire gauge. Saws used for slabbing and cutting up rough inferior timber, as well as cross-cuts, may be No. 12 and 13 by the wire gauge. The reason for using thin saws is of a twofold nature. In the first place, it takes less mechanical power to drive the machinery and saws, and in the second place there is less waste of timber. In cases where steam power is used the sawdust should be used as fuel for heating the boilers, but if not wanted for such a purpose it may be sold to the best advantage, and in large towns is generally sold by dealers at from 5*d.* to 6*d.* per bag. All pieces and fragments of hardwood trees unsuitable for any other purpose, had better be converted into charcoal, and in doing so its quality is greatly improved by the removal of the bark previous to charring. This applies in particular to different species of chestnut, limetree, and elm. Some species of hardwood trees occasionally produce valuable burrwood here and there on the stems and branches. These burrs, as they are called, consist of gnarled woody protuberances, finely twisted and knotted, and when cut up they are found in the majority of cases to be richly veined, which enhances their value very much when used for veneering and other ornamental purposes. The trees which are most prolific in producing these burrs are the birch, elm, oak, alder, and ash, and in dressing and preparing these trees for sale, the burrs are often cut off with the axe and allowed to go to waste, whereas in many cases they are the most valuable part of the tree. In order to make the most of this class of wood, the bark should be carefully removed in early summer, by which means the carpenter or cabinet-maker will be better enabled to form a correct estimate of its true value, and cut it out himself, or give directions how it is to be cut up to the best advantage for his requirements. Thoroughly decomposed leaves of deciduous trees make an excellent and valuable manure, and as it is beneficial to a large extent in promoting root growth, it can be used with advantage at the time of planting out ornamental trees and other valuable plants to give them a good start and prevent failure. The only risk which I have ever observed in using leaf-mould for such a purpose was in cases where chips and fragments of wood had been gathered along with the leaves, and as these often contain the spores of fungi they are apt to become active when placed below the surface, and thus impregnate the roots and kill the tree. In order to prevent this state of things, all twigs and chips of wood should be separated from the leaves before placing them in the dépôt to rot. Leaf-mould makes an excellent top-dressing for grass lawns and for restoring exhausted soil to fertility, therefore it should be utilised to the best advantage to prevent waste.

(OLD FORESTER.—*In the Timber Trades Journal.*)

Message from Monsieur C. Broillard to French-trained
Forest Officers.

About the beginning of this year we received from Monsieur C. Broillard, formerly Professor at the Forest School at Nancy, then Conservator at Dijon, and now in retirement Editor of the *Revue des Eaux et Forêts*, a copy of his book 'Le traitement des bois en France,' which was duly reviewed in our pages. In reply to a letter of ours thanking him for it and for the inscription which it bore "to the English-French Foresters of India, with kindly remembrance," M. Broillard writes "Je garde avec beaucoup de satisfaction la belle coupe que les pupilles Anglais de l'Inde m'ont envoiée en 1881, et je vous prie de leur témoigner à l'occasion mes affectueux sentiments."

VII.—TIMBER & PRODUCE TRADE.

The Teak Market.

MESSRS. HOAR AND BROWN report :—

	Timber. loads.	Planks. loads.	Blocks. loads.	Total. loads.
Stock August 1st, 1894	4,459	2,011	77	6,547
Landings	589	246	...	835
	<hr/>	<hr/>	<hr/>	<hr/>
	5,048	2,257	77	7,382
Deliveries	494	212	...	706
	<hr/>	<hr/>	<hr/>	<hr/>
Stock August 31st, 1894	4,554	2,045	77	6,676

The stock of timber has increased slightly this month, the figures at the present time showing 4,554 loads, being 543 loads less than the quantity held at the end of June.

Arrivals have not been so numerous in consequence of cargoes, which were expected to discharge here for purposes of selection, being now ordered direct to their destination.

Considering the limited home demand among carriage builders, &c., coupled with the scarcity of speculation, it is not regretted that imports have fallen off. However, prices still remain as they were for first-class wood, and the usual low figures are being quoted for second and third-class goods.

The market may still be described as flat, although the outlook is more promising.

Business in planks is fairly brisk with low priced parcels, the figures accepted by shippers having lately beaten record, but it is hoped the advance in rupee paper may cause a steadier market. Indications of this are already observed among shippers of later parcels, who are now asking an advance upon the earlier shipments of similar qualities held by the dealers. It is probable the value of planks may improve, provided always the importations are limited. Stocks remain practically the same.

MESSRS. DENNY, MOTT, AND DIXON report deliveries from the docks in London last month 716 loads, as against 1,264 loads for the corresponding month last year, and of this month's restricted delivery the majority was for export, showing even increased apathy in the general home demand.

The relation of supply to demand has altered but little since our last advices, and the landed stocks of logs, although considerably below the average at the time of year, are ample to meet all likely need that can be foreseen at present. Of planks, the visible quantity is apparently excessive, but as a large proportion of the sawn stuff sent by ill-advised shippers is quite unsaleable in this market, the supply of really good marketable planks is not actually too large should an average autumn demand spring up. In the floating cargo department there have been more sales for speculation than of late, although the prices reported can hardly cover the present import cost. There seems, however, no room left for economising in the direction of cost and freight, both these factors being at almost the lowest point yet touched, and saw-millers in Burmah and shipowners are alike refusing further to cut their prices and freights. In respect also to the difficult question as to the probable course of the rupee-exchange, we are inclined to agree with those experts who are of opinion that it has touched its lowest point, and that the recovery already shown during the past fortnight will be maintained for some time to come.

Churchill and Sim's Circular.

November 4th, 1894.

EAST INDIA TEAK.—The deliveries for the first three quarters of this year amount to 8,471 loads against 10,148 loads for the same period of 1893, and for September this year to 717 loads as compared with 1,385 loads in September, 1893. The figures reflect pretty accurately the dulness of the demand for general purposes. The prices are steady at a low level both for landed and floating stock. The visible supply of the latter continues amply sufficient for probable requirements.

RED-WOOD.—The stock is small, but demand very quiet.

SATINWOOD.—Finely figured logs would sell well, but there is very little demand for plain wood.

EBONY.—Large, sound, well-grown logs, in small parcels, would realize very fair prices.

PRICE CURRENT.

Indian Teak	per load	£10.	to	£16
Satinwood	per foot superficial	6d.	to	12d.
Rosewood	„ ton	£5.	to	£8.
Ebony	„ ton	£6.	to	£8

MARKET RATES OF PRODUCTS.*Tropical Agriculturist, November, 1894.*

Cardamoms	per lb.	2s.	to	2s. 6d.
Croton seeds	per cwt.	20s.	to	27s. 6d.
Cutch	„	20s.	to	32s.
Gum Arabic, Madras	„	15s.	to	30s.
Gum Kino	„	£15	to	£18
Indian Rubber, Assam,	per lb.	1s. 7d.	to	1s. 10d.
„ Burma	„	1s. 7d.	to	2s.
Myrabolams, Bombay,	per cwt.	7s. 6d.	to	9s. 3d.
„ Jubbulpore	„	6s. 3d.	to	7s.
„ Godavari	„	6s.	to	6s. 9d.
Nux Vomica, good	„	6s.	to	10s.
Oil Lemon grass	per lb.	1½d.		
Orchella, Ceylon	per ton	15s.	to	22s.
Redwood	„	£3. 10s.	to	£4
Sandalwood, logs	„	£35	to	£55
„ chips	„	£9	to	£30
Seed lac	„	30s.	to	90s.
Tamarinds	„	8s.	to	9s.

THE INDIAN FORESTER.

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Visit to the Culbin Sands, Morayshire, Scotland.

The Culbin sands consist of a series of sand hills or dunes, and form probably the greatest extent of drifting sands on the coast of Great Britain, the total length being about 12 miles, with a breadth ranging from one to three miles.

They cover an area of about 9,000 acres and are situated between the town of Nairn and the mouth of the Findhorn river in the counties of Nairn and Elgin or Morayshire.

The physical features and climate of this part of Scotland may be briefly described as follows :—the country is picturesquely undulating and consists of a series of low hills and stretches of flat country, the mixture of forest, cultivation, and moorland forming a very pleasant combination.

The geological features consist, in the Northern parts, of a mixture of sand and gravel belonging to recent deposit, whereas in the South, the old red sandstone is well developed.

A large proportion of these counties, comprising probably about one third of the whole area, is covered with fine plantations of Scotch fir, larch, beech etc.; and some well grown timber was seen in the Altyre woods and Darnway Forest, the former belonging to Sir W. Gordon-Cumming and the latter to the Earl of Moray.

It was satisfactory to note that little or no damage to these fine woods had been caused by the great storm of November 1893, which, in other parts of Scotland, such as in Perthshire, Inverness and Sutherlandshire, swept clean whole hill sides of flourishing plantations.

These woods generally occupy the low hills and gently sloping grounds, whereas nearly all the level intermediate ground is highly cultivated and productive, especially when the season is a wet one, fine crops of barley, corn, turnips, potatoes and a little wheat.

There is a limited area of moorland devoted to the pasturing of sheep, and preservation of grouse, but the moors in these two counties are not extensive.

The principal river in this part of the country is the Findhorn, which rises in the county of Inverness and after a course of about 60 miles falls into the sea north of Forres to the east of the Culbin Sands. There are a few lochs or lakes scattered over these counties, but owing to the porous nature of the soil none are of great extent.

The climate of Nairn and Moray is said to be the most genial in Scotland, which may be attributed to the following favourable causes. The extreme smallness of the rainfall, the average being only 22 inches, as compared with 32 inches at Brighton and 48 inches at Penzance. The effect of the Gulf Stream, which is supposed to sweep round into the Moray Firth and thus exercises a considerable influence on the equability of the climate. The sandy, porous nature of the soil absorbs the rain water in a very rapid manner so that damp and fogs so prevalent in other parts of Scotland, are of much less frequency in this part of the country. Another important circumstance also tends to ameliorate the climate of this part of Scotland, *viz.*, the shelter afforded to the west and south of the ranges of Ben More and Ben Wyvis, which have the effect of drying the prevailing west winds by depriving them of their moisture. All these favourable conditions combine to render this locality one of the most sunny parts of North Britain and the counties of Nairn and Moray are said to enjoy forty more sunshiny days than any other part of Scotland.

Another important result of the favourable nature of the climate is that the crops ripen very early, considering the latitude, and are often harvested at the same time as those in most parts of the south of Scotland, the drying nature of the soil, which in this case is considered prejudicial to agricultural interests, is, to a certain extent, counterbalanced by the presence of boulders and gravel mixed with the sand, which have the effect of checking too rapid evaporation, and retaining the moisture. The climate of these counties is also most favourable for the cultivation of all kinds of European fruit trees, and even peaches ripen easily in the open air if grown on a brick wall.

As might be expected, the dry nature of the climate exercises a most remarkable effect on the preservation of buildings and this is specially noticeable in the case of the Findhorn bridge which, though erected in the year 1832, still looks as if it had been constructed only 10 or 12 years ago.

But to return to the Culbin sands and the causes which have led to the formation of these extensive dunes. Considerable diversity of opinion exists amongst geologists. The following theories, however, may be assumed to be the probable causes which have led to their formation. That large quantities of sand have, during recent centuries, been excavated by the action of the tidal waves from various parts of the Sutherland and Rosshire coasts and carried by the currents and waves towards the head of the Moray Firth and

deposited on the shore near Nairn. It also seems certain that the area now occupied by the Culbin sands has gradually become depressed probably from about the middle of the sixteenth century, this theory being supported by the fact that, at various places along the neighbouring coasts, notably at Lossymouth, several sea beaches are discernable, some of them now situated at a considerable height above high water mark. It may therefore be assumed that, in accordance with a well known volcanic theory, the elevation of the coasts in the vicinity has possibly led to the depression of the area now occupied by the Culbin sands. In any case, previous to the year 1650 the site of the Culbin sands constituted the important Baronry of Culbin, which was then considered a most fertile tract and was called the granary of Morayshire.

From that period, however, the drifting sands continued to make steady progress in its movement along the coast in an eastern direction, till about the year 1700 they had completely swallowed up the greater part of this fertile tract.

It is known that many small crofts or hamlets, including a church, were buried in the drifting sand and that no traces of them now exist.

So sudden, on some occasions, was the advance of the sand-drift, especially during the prevalence of western gales, that fine crops of corn, &c., were often covered up in a single night and on one remarkable occasion a ship-load of smuggled brandy was hopelessly buried, to the great chagrin of the expectant recipients, while thirsty descendants continue to search for the missing liquor up to the present day. The eastern movement of the sand has also had the effect of modifying the course of the Findhorn river, which at one time entered the sea about three miles further to the west, and at the time an extensive area was submerged owing to the accumulation of sand at the mouth of the river.

About the year 1690 the important fishing village of Findhorn was buried beneath the drifting sand and the site had to be changed one and a quarter miles further to the east, where even now, its existence is considered extremely precarious. This village was at one time one of the most important fishing centres in the North of Scotland, but owing to the accumulation of sand in the estuary of the Findhorn river, even small fishing boats cannot, without difficulty, now enter, and the fishing trade of this village has, therefore, been completely ruined.

The action of the drifting sand has, however, been considerably modified by the floods of the Findhorn river, which is one of the most rapid streams in Scotland and liable to violent and sudden floods. Of these disasters, the most important was the great flood of 1829, a description of which, even though it may possibly be considered ancient history, may interest the readers of the *Forester*.

This great inundation, which forms one of the most appalling events of this part of Scotland during the present century, took place on the 4th August 1829 and is still remembered by the oldest inhabitants with considerable awe. The season had been an unusually dry one, when suddenly, on the 2nd and 3rd August torrents of rain, accompanied, it is said, by several waterspouts, fell over the catchment area of the Findhorn river on the high grounds in the county of Inverness.

The result was that the river Findhorn rose to an unprecedented height and at one place, near its juncture with the Divie, it reached 40 feet above its usual flood level. The flood did immense damage to the river banks and neighbourhood and great numbers of trees and cattle, also crops and nearly all the bridges on the river were swept away; a considerable area of country in the lower course of the river near Forres was submerged and fishing smacks sailed about freely in the work of rescuing the inhabitants of the villages and hamlets. The total damage done by the flood was immense, and was estimated at £20,000.

The present condition and formation of the Culbin sand hills may be described as follows. As already stated, the original area covered up appears to have been about 9,000 acres, but this has now been reduced by means of plantation and other reclamation works to about 5,000 acres. The appearance of this barren and shifting area is desolate and bleak in the extreme but the dreariness of the scene is somewhat relieved by occasional glimpses of the sea and the picturesque landscape stretching towards the south. The formation of these dunes has been effected in the usual manner and may be described as follows. The loose sand, after being deposited by the tides near Nairn, is slowly driven along by the July winds up the gentle inclines of the sand hills and forms long slopes, but on the eastern sides it falls over and forms steep scarps, as is usually the case with drifting sands. The sand hills therefore travel along the coast in parallel ridges in an easterly direction, the highest elevation attained being 100 feet above sea level.

The sand is extremely fine, but here and there, apparently along the old course of the Findhorn river, there are some beds of gravel and these hollows are generally filled with water during floods or high tides. *Underneath the sand in some places, there is apparently a bed of good soil, which probably formed the cultivated area before it was covered up, about three hundred years ago.* There also seems to be a certain amount of moisture lower down, due to percolation from the sea or Findhorn river and these conditions tend to demonstrate that planting operations in most places would not be attended with so much difficulty as might be expected. The vegetation of the unreclaimed and shifting portion of the Culbin sands is extremely scanty and consists mainly of tufts of

Bent grass (*Psamma arenaria*) and a few scattered bushes of gorse and broom, but considerable areas are altogether barren.

The wire-like roots of the Bent grass are eminently suited for fixing the drifting sands, but it is stated that the binding action of this grass was for many years interfered with by the neighbouring villagers who ruthlessly pulled it up for the purpose of thatching their houses, thus leaving the sand to drift about at the mercy of the winds. This pernicious practice was, however, put a stop to by a special Act of Parliament which is apparently still in force. It is most satisfactory to note that there is no grazing of cattle or browsing of flocks in these sand hills, which greatly facilitates the planting operations.

Rabbits appear to be the only quadrupeds which inhabit this sandy area and an interesting collection of the principal birds found on this coast, besides other sand relics, such as portions of agricultural instruments, &c., are to be seen at the Falconer Museum at Forres, where also may be observed a splendid collection of extinct monster fossils from the Siwalik hills, N. W. P., India.

The site occupied of the Culbin sands is comprised in the private estates of Brodie Moy, Kincorth and Burtness, so that State interference in the reboisement work of the sand hills would have presented considerable difficulty and does not seem to have been desirable. Up to the present, therefore, the work has been left entirely in the hands of the neighbouring proprietors who, it is satisfactory to note, have done a good deal towards checking their inroads, though much more doubtless might have been done.

The result is that a considerable area, probably amounting to about 5,000 acres has been planted up, principally on the south and west sides of the sand hills.

These planting operations were first commenced about fifty years ago by Mr. Grant of Kincorth and the success of this work was such that he obtained the Highland Agricultural Society's gold medal as a special mark of their approbation.

This planting, it may be observed, was started on pure sand, the species used being mainly Scotch fir and birch, the former being planted on the pure sand and the latter in the low lands and hollows between the hills.

The Kincorth plantations are situated on the south side of the sands about two miles from the sea and extend for about a mile along the border of that estate, the average breadth being about a quarter of a mile.

The trees have evidently been planted close together and have been done fairly well, the average height being about 40 feet and girth from 3 to 4 feet. The ground below the trees is now well covered with grass, heather and some humus which seem to have effectually checked the drifting of the surface sand, whereas the trees themselves form an effective barrier against the progress

of the new sea sand towards the neighbouring cultivated lands. Following the example of Mr. Grant, the neighbouring proprietors of Brodie and Moy also started plantations further to the west, which now cover an area of about 3,000 acres, and extend from the edge of the cultivated area to the sea shore, and as might have been expected, have effectively stopped the drifting sand in that direction.

Some extensive planting operations have been undertaken during the last 20 years by Major Chedwick of Findhorn, in that part of the sands called Burtness and situated on the left bank of the Findhorn river, at the east end.

These plantations now cover an area of about 100 acres and are most creditable to the energy and perseverance of the proprietor.

It may be noted, however, that the main object of these operations has apparently been to form an immense rabbit warren and the difficulty of rearing the young trees along with the rabbits may easily be imagined.

Every new patch of plantation has consequently had to be fenced with wire netting for protection from the rabbits till the trees were about 10 years old, by which time, owing to the hardness of the bark, they are considered protected from serious damage.

The system here adopted when any new area is to be operated upon is to cover the loose drifting sand, with high brushwood, grass, &c., which in a year or two decays and forms a slight vegetable covering, after which the young plants of scotch fir, spruce, larch, birch, &c., are planted out.

Considerable areas were also observed, sown with furze, broom and various kinds of sand-binding grasses; also the planting of the indigenous bent grass is undertaken with marked success.

The result of these operations is that, in addition to a thriving rabbit warren and pheasant preserve, the sand drifts towards the upper portion of the Findhorn bay have been stopped, or at least much modified.

It is also stated that before Major Cheswick's plantations were started, the loose sand used to be transported by the westerly wind right across the Findhorn bay and deposited on the fertile fields of the ancient village of Kinloss, but now, this state of affairs has completely ceased. Eastward, however, towards the mouth of the Findhorn river, the drifting sand continues to advance unchecked, and if much more extensive operations are not undertaken to arrest its progress, the estuary will soon become choked up and the village of Findhorn again buried or swept away by the first great flood of the Findhorn river, combined with the action of the drifting sand on the river bed.

E. Mc. A. M.

Disease of Cocoanut Trees in Travancore.

Under the above heading a query appeared in the *Indian Forester* for September last. As no answer appeared in your October issue, I venture to give the following attempt at a solution of the question, though it only concerns one of the reasons advanced, *i. e.* insect attacks. Scientifically, I should think any one of three theories, insect, fungus, and exuberance of sap, might account for the phenomenon. I should not care to express an opinion about the 'falling star' explanation.

Your correspondent states that they are convinced it is not the work of *Oryctes Rhinocerus* or of *Batocera rabus* (a Longicorn). I think, however, that these are probably not the only insects to be taken into account. There are some seven insects known to prey on the Cocoanut, the particular insect present depending on the geographical position of the tree; of these, two, *Rhynchophorus ferrugineus* & *B. rabus* are known for their tunnelling propensities. They are both Coleoptera. *Oryctes Rhinocerus* and *Gangara thyraxis* (a lepidoptera) are injurious to the leaves. I conclude the damage was not due to the extra abundance of the larvæ of the latter, as its presence would have been noticed. From what your correspondent states, the above insects, therefore, may be left out of account. The fifth insect is another weevil, *Sphænophorus planipennis*, said to be injurious to Cocoanuts in Ceylon.

The last two are both Coccidæ. If the insect theory is to hold, it will be perhaps to these small insects that we shall have to look for the damage. Two members of this family feed on the Cocoanut, *Aspidiotus destructor* and *Dactylopius cocotis*. I do not know that either of these insects has been reported in India, and it may be ultimately found that it is an insect, if insect it be, nearly related to one of these. In the Indian Museum Notes, *A. destructor* is described as follows:—

"A minute insect which, to the naked eye, looks like a mealy 'Scurf' on the leaves. It has been extremely destructive to 'Cocoanut palms both in the Laccadive Islands and in l'Ile de 'Réunion. It sucks up the juices of the leaves to such an extent 'as to sap the vitality of the trees and to destroy great numbers 'of them."

This would cause the drooping of the leaf shoot as mentioned by your correspondent.

As the genus *Aspidiotus* is parthenogenous, thus resembling Aphidæ, enormous numbers of young would be produced in the spring and summer, consequently a correspondingly large amount of sap, which the trees could ill afford to lose, especially in an extra hot year, would be sucked up.

With regard to remedies. For young plants, two to four feet high, I believe a mixture of kerosene and soap diluted might be used without evil effect, but it would have to be sprayed on several times. For older trees, if the attack is really a Coccid one, I shall also be interested to know the remedy.

E. STEBBING.

CAMP KAMABERA, SINGBHUM,

November 15th.

Obituary—M. Corbett.

We regret to have to record the death at Bahraich on the 25th inst. of Mr. Corbett, Forest Ranger, from fever, after a few days illness. Mr. Corbett passed his probationary service in the Oudh Circle, returning there to the charge of a Range after obtaining a certificate by the H. S. at the Forest School, Dehra, in March 1894. He stood third on the list and obtained a certificate with honours in an exceptionally full year. His early death, after only a few months service, removes a promising young Officer who was in every way suitable for special advancement in the executive branch. His fellow students of the 1892-94 class will hear of his death with great regret, a regret which is fully shared by the staff of the Dehra Dun Forest School and the Officers of the Forest Department of the N.-W. P. and Oudh.

II.—CORRESPONDENCE.

The Malabar Steam Sawmills.

On reading the article on the Malabar Saw Mills in the September number, I found that the Printer's Devil had made a mess of Mr. Brown's initials. Mr. A. Brown is the proprietor of the Saw Mills and Mr. H. Brown, his brother, has the credit of erecting the buildings and machinery.

I forgot to mention amongst other interesting things, that I saw an automatic filing machine. This beautiful piece of mechanism was as perfect as human ingenuity could make it. The band saw revolved on two drums, and as the teeth of the saw passed a fixed spot, a file descended on them at regular intervals and worked at each tooth. It is impossible for me to describe in so short an article, so intricate and beautiful a piece of machinery.

Mr. Brown had also the usual emery wheel for machinery saws, worked by the engine.

I was much interested in some specimens of wood pavement I was shown. The woods selected were eminently fitted for the purpose; viz., *Xylia dolobriiformis* and *Hopea parviflora*. There were several circular saws at work. On looking over my notes, I find I made a mistake in my last article. It took $4\frac{1}{2}$ minutes to saw the Candy of timber, which I timed. This is good enough work. An American planing machine was as simple and effectual a piece of machinery as I have seen yet and was engaged in planing white cedar planks for ceiling work. A visit to these works would well repay any engineer or Forest officer passing through Calicut.

R. M.

Pyngado for Wood Pavement.

SIR,

I regret to see at page 413 of "*The Indian Forester*" for November 1894, a letter depreciatory of the value of Pyngado (*Xylia dolabriformis*) for wood-paving purposes. It is one of my most ardent wishes to see all the streets of London, and of our other large home cities, paved with this wood, which, I believe, notwithstanding Mr. Talbot's apparent opinions, to be eminently adapted for such a purpose. And if we in India, working with native labour and paying for the same in a very depreciated silver currency, cannot place our best hardwood on the London market at a cheaper rate than the Jarrah and other woods of the Australian colonies, where white labour is employed and paid for in gold, then there must be something radically wrong with our method of work, our supervision of subordinates, our energy or our employment of that energy and, more especially, of that technical education upon which we have hitherto rather prided ourselves as a Service. If there is any difference at all as to freight to London, then it is probably slightly in our favour,—whilst our landing charges are also paid for in silver and not in gold till the ship is ready to sail.

I am writing to ask my friend Mr. Bagley, Chief Engineer in the Burma Railway branch, to give me the benefit of his opinion as to the merits or demerits of Pyngado for wood-paving purposes ; for I recollect that about 10 years ago various pieces of wood-pavement were laid down in Rangoon. I further recollect that, up to my leaving Rangoon in 1892, I never used to see these pieces of wood-pavement without admiring the way they maintained themselves.

It does not follow that, although the 'Jamba' of Bombay is *Xylia dolabriformis*, it must necessarily have the same durability and technical qualities as the 'Pyngado' of Burma ; but if Mr. Talbot gives the specific gravity of the wood he deals in,

then a basis of opinion can be formed, seeing that, *for one and the same species of wood*, the heavier timber has the greater durability. Soil and climate are of vast importance with regard both to the amount of increment and to the technical quality of the wood produced by any given kind of tree: hence Mr. Talbot can hardly agree that because he does not think the Bombay 'Jamba' suitable for wood-paving, therefore the 'Pyingado' of Burma must also be subject to similar or identical disabilities.

His extract from the report saying that—

"We have not yet found anyone to take an interest in the 'Jumba. It is so hard that the expense of cutting into blocks 'would be excessive."

shews that something has been aimed at on the Bombay side, which is entirely different from what we want in Burma. *We want to convert our Pyingado into wood-pavement blocks, and to export them in the converted form; for, if seasoned, our fine iron-wood would break the teeth of saws.*

Anyone who has travelled through the forests of Burma must recollect the thousands of bare dead stems which are to be seen throughout most of the recently cleared land and the old Taungya (*Jhoom*, *Kumri*) land in all the lower dry forest tracts. The vast majority of those dead stems are Pyingado, which the Burman does not try to cut down after girdling; for he knows that, when once seasoned, the *Xylia dolabriformis* of Burma will turn the edge of his *Dá* or bill, it becomes so hard.

The forests of Lower Burma alone could yield probably from 200,000 to 300,000 tons of Pyingado per annum, and at a much lower rate than the Rs. 40 per ton for which 1,000 to 2,000 tons a year could be extracted in North Kanara according to Mr. Talbot.

Speaking from memory—for records are not at hand here in camp—details of the working of a little Pyingado saw-mill, formerly run by me in the Rangoon Division of the Pegu Circle of Burma, will be found in the Annual Reports for 1884 and 1885. Extraction for the Railway Department began about 1881 and was continued, first for the Forest Department and then afterwards for the late Mr. Rosner, who took over the saw-mill from us in 1885, at any rate until 1892 when I left Burma. From a comparatively small tract of forest, something like 40,000 to 50,000 logs of Pyingado must have been extracted within 10 years: and this from forests which never were anything like so rich in Pyingado as many of the lower hill forests of Tharrawaddy, Prome, Thayetmyo, Henzada, and Bassein on the Irrawaddy side, or of Pegu, Shwegyin and Toungoo on the Sittang side of Lower Burma alone, without taking Upper Burma into account at all.

Whatever London reports on Jamba may say, I am very hopeful that within a year or two we shall see a commencement of

the paving of London streets with blocks of pyingado shipped from Rangoon, Moulmein, or Bassein in Burma. What is really wanted in order to ensure a start, and probably a very successful start, of a new and important industry, in this direction, is that the Government of India should sanction a certain outlay for the purpose of first obtaining permission from the London Vestries, and then the laying down of short stretches of pavement (say 50 yards at each experimental point) here and there in different localities like the Strand, Fleet Street, Cheapside, &c.. so as to enable the authorities at home to form an opinion as to its suitability for importation on a large scale. The opinion would probably be biased at first, but I believe the good qualities of pyingado would force any such prejudice aside. It would pay Government extremely well in the long run, either to send home one of their Forest Officers of recognised business capacity, in order to run this particular branch, or else to wait till they have such an officer at home on furlough, and then utilize him for this particular special duty. But the former is the preferable alternative; for loss of time must in such a case mean lost opportunity—and opportunities once lost, seldom return. Now is the time for the Government of India to take active steps towards advertising and pushing their wares, before the Australian Colonies secure the London market with their Jarrah and other hardwoods. In this struggle for the greatest market in the world, the Australian Governments are not letting the grass grow under their feet like the Government of India, but are using every endeavour, both by means of selected officers and of a suitable outlay, for what are, after all, purely advertising expenses, to gain what one might call a firm foothold on the pavement of London and of all the great cities in Britain. That '*Good wine needs no bush*' is an old proverb, and I am sure that if once the splendid qualities of pyingado had an opportunity of becoming known at home, they would soon be so well appreciated as ultimately to lead to the Burma exports of converted Ironwood being in excess of those of teak and of padauk combined. But nothing worth having is obtainable without exertion; and the longer the Government of India continue their *laissez faire* policy in respect of the forest produce with which they can supply Europe, the more will the market fall into the hands of the Australians; the greater will be the difficulty of obtaining any subsequent hold at all on the home market, and the less the chance of their realizing a handsome revenue that is possibly now within comparatively easy reach.

J. NISBET,

CAMP, LACHIWALA :
16th December, 1894.

} Dy. Director, Imperial Forest School,
and Deputy Conservator of Forests,
Burma.

New Pension Rules for Forest Officers.

DEAR SIR,

The recent reports regarding the extension of the more favorable service and pension rules to Forest Officers, refer apparently to Secretary of State's men only; and if this is the case, the Government is doing a very great injustice to those officers who were previously selected and appointed in India, and who have borne the greater burden of the earlier struggles of the Forest Department, at a time when the emoluments were less, and the discomforts and difficulties of the life greater than they are now.

As long as those "locally appointed" are qualified for admission and retention in the Department, and as long as they are on the same footing as regards pay, work and responsibilities, it would be exceedingly unfair to treat them with less consideration in the matter of service and pension, than is shown to their colleagues appointed from England.

If the new rules are to have retrospective effect as regards the men appointed from Home, then they should apply also to those who were in the controlling ranks of the service at the same time as the Home men. Any distinction between the two sets of officers would be in direct opposition to the recommendations of the select committee of the House of Commons, when dealing with the grievances of the services generally.

In their own interests the Secretary of State's men should support the claims also of those appointed in India, for if the former are not to have their promotion retarded towards the conclusion of their service, it is obvious that the latter must be able to retire, without being required to put in a *greater number of years service* than the former.

FIDES SERVANDA EST.

Germination of Kharshu.

DEAR SIR,

The Kharshu (*Quercus semecarpifolia*) seeded here most abundantly this year in July, and, to judge from their size, the acorns were of very good quality. On the slopes of "Cheena Peak" I dibbled in acorns over about 60 acres and started a nursery in

which I put about 7 maunds of seed or some 35,000 acorns. The nursery was on a gentle S. slope at an altitude of about 7,800 ft. with good soil and in the midst of a fine natural Kharshu forest. The sowings were carried out about the end of July with most of the acorns already sprouting.

All the labour has come to nothing, however, for not a single seedling has shown itself in the nursery, and none have been found in the forest, either from the acorns dibbled in, or from those naturally sown. The failure is the more noticeable as, certainly, 95 % of the acorns germinated, and put out vigorous radicles but there they stopped. I hardly think that the fortnight without rain in Naini Tal just after the sowing, is altogether responsible for the failure as, even then, the sun hardly ever penetrated through the clouds which enveloped "Cheena" and kept the atmosphere moist and cool, just such a one as the Kharshu generally lives in.

I should be glad to know what are the experiences of any others who have had dealings with Kharshu this year.

F. A. LEETE.

Note :—We hope some other Forest Officers will help to clear up the difficulty. In Jaunsar, the Kharshu seeded in June and when we left the hills in that month, the ground was covered with germinating seed. In October, however, few seedlings were visible, but we cannot explain the reason. On the subject of the curious mode of germination of Kharshu (as also, to a great extent, of 'Moru' (*Quercus dilatata*) we would refer our readers to Pandit Keshavanand's interesting article in our Vol. XVII.

Hon. Ed.

Flowering of a Bamboo in S. Canara.

DEAR SIR,

The bamboo known in this District as Ame Wotay flowered and seeded everywhere in the Forests of South Canara last February. About half the dying culms are now again attempting to produce a second crop of seed, naturally a poor one. The February crop must have been a very heavy one, for the ground is densely clothed with a carpet of young plants from 1 in. to 4 in. I have issued orders to the Rangers to collect as much seed as possible next February. This bamboo is a very handsome one, the

culms being very straight, thornless and from 2 in. to 5 in. in diameter. It is used for basket and mat making and is especially useful for putting up temporary Forest Camps, as huts can be run up in half an hour. This bamboo very closely resembles *Beesha Travancorica*; but unlike it, is not a producer of large fleshy seeds. The Villagers collected large quantities of the seed which they have husked and eaten in the shape of porridge, cakes, &c.

I collected some flowering specimens; but they were unfortunately ruined by the heavy rain and damp. Of seedlings, I have secured a considerable stock, and will distribute them to any one wanting them and caring to pay the cost of carriage.

R. MORGAN.

III.—OFFICIAL PAPERS & INTELLIGENCE.

Enquiries regarding Indian Trees.

The following circular has been issued by the Inspector General.

“In forwarding herewith, for information and distribution ‘among such Divisional Forest Officers as you may select for the ‘purpose, copies of two notes on (1) *Xylia dolabriformis*; and ‘(2) *Chickrassia tabularis*, I have the honour to request that you ‘will be good enough to cause specimens of the wood (seasoned if ‘possible), &c., of these trees to be forwarded to the Reporter on ‘Economic Products, Indian Museum, Calcutta. The object of this ‘requisition is to obtain collections of selected specimens of the ‘various portions or products of the two trees for purposes of ex- ‘hibition and experiment at the Imperial Institute, London, and ‘at the Indian Museum, Calcutta, and the notes indicate the con- ‘tributions which it is desired should be made.”

We append the note on the first mentioned species for our readers’ information.

1. Objects of the Collections.—Before proceeding to give an abstract of the available information on this subject and to indicate the collections which it is desired should be made, it may perhaps be as well to mention the circumstances that have led to the selection of two timber-yielding trees for special consideration this year.

The policy adopted by the Government of India with regard to all other products required for the Imperial Institute has been to restrict investigations to a fixed number of articles each year. The Inspector General of Forests has concurred that similarly it would suffice to confine the preparation of logs of timber, in

illustration of our more important commercial trees, to two species a year. Last year the timbers of *Albizzia Lebbek*, and *Ptrocarpus indicus* were dealt with, but the experience thus gained has shown that an economy of time and labour would very possibly be effected were every product that a tree affords taken in hand at one and the same time. Instead, therefore, of indenting on local officers for the resin of *Xylia* this year, the timber at some future date, and its oil-yielding seed at still another period, it is proposed that the present enquiry should, in the matter of collections, dispose of that species once and for all. This is the more necessary since at the Museum it is contemplated that over above the panels of timber (which are intended to illustrate our trees) glass cases will be placed, in which would be shown a botanical specimen of the plant, a drawing of its flowers, etc., a photograph of the tree, and small samples of each of its useful products, such as its gum, dye, fibre, medicine; also interesting articles of dress, furniture, or sport, etc., etc., made from its timber, fibre, branches, leaves, etc., etc. Such collections would therefore illustrate graphically the value of each tree. By concentrating enquiry in this manner, it is believed that information regarding many products and uses of the trees in question will be brought to light that may possibly have been entirely lost sight of through the former system of special indents, product by product. The extent of these auxiliary contributions, over and above the supply of logs of timber, is thus a matter left to the discretion of the officers who may have to deal with this subject. Photographs (in duplicate) of typical examples of each species of tree would be most acceptable. If taken specially, a man of average height should be placed near the stem, and if possible the photograph should give little else but the tree intended to be shown.

In concluding this explanatory note, it may be as well to add that attention should not, of course, be confined exclusively to the various subjects dealt with in the abstract given below. If other uses or other products are known to the officers who may conduct the enquiry and prepare the specimens, these would be of very special interest, and should most certainly be contributed.

(2). *Habitat*.—*Xylia dolabriformis*, the 'Pynkado' is a large deciduous tree met with in the Central Provinces, South India, and Burma.

Information on the following among other points is desired :—

(a) Its vernacular name or names in your district, given in printing Roman character.

(b) The season at which it flowers and fruits. This is most important in order that the period when seeds can in future be obtained may be known.

(c) The area of its occurrence and prevalence; that is to say, the part or parts of your locality where it is most abundant or most accessible.

(d) The nature of the soil and of the climate on which it is seen to greatest advantage.

(e) The names of the three or four most common trees with which it is generally associated.

(f) The height it attains and the diameter of its stem when full grown.

(g) The number of years it is supposed to grow before attaining these proportions.

(h) The method by which it is most readily propagated.

(i) Kindly furnish at least two botanical specimens showing leaves, flowers and fruits. You will find a note on how to dry specimens in *The Agricultural Ledger*, No. 4 of 1894, that may perhaps be of some use in indicating the nature of the samples that might be furnished.

It is commonly reported to afford the following products :—

3. Resin.—It is supposed to yield a red resin more especially in Burma. Kindly supply a sample of not less than 5lbs. in weight. The lac insect is reported to be sometimes found on it. If this be so, please furnish a specimen of the twigs encrusted with lac of about the quantity mentioned for the resin.

Information on the following points would be most valuable :—

(a) Does the resin exude naturally or only in consequence of some injury? If the latter, kindly describe the process adopted to secure a supply.

(b) At what season of the year is it obtained?

(c) How much does each tree afford per annum?

(d) At what price per 100 lbs. could it be landed at the railway station or local mart?

(e) How much approximately might be expected to be produced annually from your district?

(f) Is it used by the Natives, and for what purposes?

(g) Has the resin any special name by which it is known in local trade?

(h) Does the tree possess any advantage as a plant on which to rear the lac insect?

4. Oil—It is stated that the seeds yield an oil. Kindly furnish a sample of some 10 lbs. of these seeds. If the oil is prepared locally, it would be most desirable if you could furnish at least two quart bottles of it, and, say, 4 lbs. of the oil-cake left after expression of the oil.

On the subject of the oil, the following points might be investigated :—

(a) What weight of seeds might be expected from each tree?

(b) At what price could the seed be sold per 100 lbs.?

(c) What is the yield of oil to the weight of seed employed in its preparation?

(d) Is the oil obtained by hot or by cold expression? Describe the process.

(e) What is the oil used for, and what are its reputed properties?

5. Timber.—This hard and very resinous wood seems to be highly appreciated in the localities where it is to be had in fair abundance. It is generally known as Iron-wood because of its weight (60 to 86 lbs. a cubic foot). Is this weight correct?

It would be desirable to obtain from each contributor one log, about 7 feet long—a size that would be sufficient, when cut in half, to make two good samples. One or two logs would be used up in fittings in order to show the nature of the wood. If possible, one log should bear (at least on one side) a portion of the bark. The selected log which each contributor proposes to supply should be well seasoned by being kept in a dry shed for some time before being despatched, and it would *not* be necessary to dress it in any way. That can be done on its arrival in Calcutta and London.

It may be anticipated that as the result of this requisition some 8 or 10 logs may be obtained from the whole of India; and, if so, that quantity would suffice. It is desirable to see whether the wood varies materially in the various provinces where it occurs, and also to have one or two spare logs to give to the trade for experimental purposes. Should, however, this requisition result in our obtaining only two or three logs from all India, it might then be necessary to indent a second time. These circumstances are mentioned so as to obviate the risk of too much or too little being supplied. This would be prevented by each intending contributor informing the writer whether or not he could supply a log of the nature specified. On these replies coming to hand, a selection could be made and the exact quantity required subsequently requisitioned.

Information on the following points would be desirable:—

- (a) At what price per ton could the timber be landed at the nearest railway station or seaport?
- (b) How much a year might be expected from your forests?
- (c) What sizes could be supplied?
- (d) For what purpose is the timber mainly used locally?
- (e) If not very costly, could you supply a selection of the smaller articles usually made of it, more especially those that might be both attractive, and which would help to exemplify its special properties?

6. Conclusion.—While no restraint is desired to be placed on the liberality of contributors both as to the communication of useful information or the supply of specimens, it is not intended that the above categorical statement should be regarded as an imperative obligation. It is hoped that by representing, as has been done, all the known properties of the plant, and by pointedly drawing attention to the chief features regarding it (on which information is desired), the labour of the officers who may have to reply will be greatly lessened, and that the information ultimately obtained (from all parts of India) will afford material for a more comprehensive account being published than we at present possess.

IV.—REVIEWS.

The Forests of Travancore.

Through the kindness of the Conservator, Mr. T. F. Bourdillon, we have received the Report on the forests of his charge which was published in 1893. It is very full and detailed and serves admirably as a basis for the yearly record of progress and administration which may now be expected to issue. As our readers know, Travancore is a large and prosperous Native State on the Malabar coast in the extreme South of the Indian Peninsula, between the parallels of North latitude $8^{\circ} 3'$ and $10^{\circ} 22'$ and occupies an area of about 7,000 square miles. It has a population of about $2\frac{1}{2}$ millions and gives a revenue of 77 lakhs with an expenditure of 70 lakhs. The lands of the coast are all cultivated, the forest country occupying the slopes and crests of the Western Ghats up to a maximum elevation of 8,840 feet. The climate of Travancore is very equable, owing to the sea-breezes, the temperature on the plains rarely rises over 90 degrees, while in the coldest weather it rarely falls below 70 degrees. On the hills, of course, the changes are greater. The rainfall is heavy: on the coast it varies as one proceeds north, from 41 in. to 114 in.; while on the Ghats it may run up to as much as 210 inches in the hills of Peermaad.

It would seem that Forest Conservancy is of very ancient date in Travancore compared to its commencement in British India, for Mr. Bourdillon mentions that in 1816 to 1820 a Deputy Conservator was stationed at Ráni to see teak felled and sent down to Allepey, where it was sold by the Commercial Agent who was the Conservator of Forests and regulated also the Cardamom collections.

For the general description of the forests we cannot do better than quote Mr. Bourdillon, who writes as follows:—

“In describing the forests within the above boundaries, I cannot do better than divide the whole region according to the catchment area of each river, a method which will enable me to describe the forests and the rivers themselves in detail, and afterwards to sum up the results of my explorations. It must not be supposed that this area includes all the waste land, or even all the forests in Travancore. Outside this area, there is a considerable extent of land suitable only for forests, or grazing, such as the Velimala hills near Nagercoil, but these are isolated blocks which may be left out of consideration, until the rest of

'the forest area has been put under a thorough system of conservancy.

'From what has been already said, and from the analogy of other countries, it may be inferred that the forests of this region do not all present the same characteristics, and I have, for convenience sake, divided them into four classes.

'(1) Heavy moist forests of evergreen trees.

'(2) Land originally covered with moist forest, but now overspread with scrub of various ages, the resulting growth after being abandoned by hill cultivators.

'(3) Deciduous forest, with grass growing under the trees.

'(4) Rock, and land covered with short grass, and useless for any purpose except pasture.

'The *first* class of forests at one time extended all over the low county of North Travancore, but as it covered the best soils, it has been gradually cut down there, and is now confined to the slopes of the Hills, and to perhaps one-third of the upper hill plateaux. The trees composing it grow very close together, and exhibit an extraordinary variety of species, and owing to the absence of grass and to the fact that the trees themselves are evergreen, forest fires do very little harm here. In spite of the great choice of woods they offer, these forests are, as a rule, less valuable than the deciduous forests of class 3, the greater part of the timbers being unknown; nevertheless some of the woods command a high price.

'The following are the most important:—

'Ebony— <i>Diospyros melanoxylon</i> ?	Mala-uram— <i>Pterospermum rubiginosum</i> , and 2 other kinds.
'Kambogam— <i>Hopea parviflora</i> .	Olan kara— <i>Elæocarpus serratus</i> , and 2 other kinds.
'Anjili— <i>Artocarpus hirsuta</i>	Peru— <i>Ailantus malabaricus</i> .
'Jack— <i>A. integrifolia</i>	Dammer— <i>Canarium strictum</i> .
'White Cedar— <i>Dysoxylum malabaricum</i> .	Vengkotta— <i>Lophopetalum Wightianum</i> .
'Red Cedar— <i>Cedrela Toona</i> .	Kadapilavu— <i>Kurrimia paniculata</i> .
'Punna— <i>Calophyllum tomentosum</i> .	Mango— <i>Mangifera indica</i> .
'Nanga— <i>Mesua ferrea</i> .	Redwood— <i>Gluta travancorica</i> .
'Gamboge— <i>Garcinia Cambogia</i> and 4 other species.	Then chera— <i>Semecarpus travancorica</i> .
'Puthangkolli— <i>Pœciloneuron Indicum</i> .	Ambalam— <i>Spondias mangifera</i> .
'Cotton— <i>Bombax Malabaricum</i> .	Shurali— <i>Hardwickia pinnata</i> .
'Chini— <i>Tetrameles nudiflora</i> .	Malam puli— <i>Dialium ovoideum</i> .
'Enna— <i>Dipterocarpus turbinatus</i> .	Kurangadi— <i>Acrocarpus fraxinifolius</i> .
'Payini— <i>Vateria indica</i> .	Mutta Kongu— <i>Pygeum wightianum</i> .
'Vedi pilava— <i>Cullenia excelsa</i> .	Naval— <i>Eugenia</i> , several species.
'Pola— <i>Sterculia alata</i> .	

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| <p>‘Manimarutha—<i>Lagerstroemia flos-reginæ</i>.
 ‘Kadamba—<i>Adina cordifolia</i>.
 ‘Pala—<i>Chrysophyllum roxburghianum</i>.
 ‘Do.—<i>Dichopsis elliptica</i>.
 ‘Karin thuvara—<i>Diospyros microphylla</i> and <i>insignis</i>, and 2 other species.
 ‘Erilappala—<i>Alstonia scholaris</i> (often found also in grass land.</p> | <p>Nutmeg—<i>Myristica laurifolia</i> and 4 other species.
 Cinnamon—<i>Cinnamomum zeylanicum</i> and others.
 Kola mava—<i>Machilus macrantha</i>.
 Thondi—<i>Bischofia javanica</i>.
 Aval—<i>Holoptelea integrifolia</i>.
 Ara anjili—<i>Antiaris toxicaria</i>.
 Fig—<i>Ficus</i>, 9 or 10 species.</p> |
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‘The *second* class of forest contains no timber of any value except Vaga (*Albizia procera*), as the bushes and scrub springing up after a burn are of useless kinds of trees, such as Ama—*Trema orientalis*, Vattakanni—*Macaranga Roxburghii*, *Clerodendron infortunatum*, *Mallotus albus* and Vettilapatta—*Callicarpa lanata*, and so on.

‘All of these bushes or small trees are short lived, and after growing for perhaps ten years give place to better kinds of trees.

‘In this class are included all lands cleared for cultivation of any sort, whether for coffee, tea, rice, or other produce.

‘The *third* class consists chiefly of forest growing on poorish land lying at the foot of the hills, and is very abundant in South Travancore. These grass forests are found also covering the ridges and higher ground, where the soil is too dry for the moist forest to grow. A small part of the hill plateaux also is covered with forest of this description.

‘The deciduous forests contain a much smaller number of species of trees than the moist forests, but their value is greater. The most important of these are—

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| <p>‘Teak—<i>Tectona grandis</i>.
 ‘Blackwood—<i>Dalbergia latifolia</i>.
 ‘Sandalwood—<i>Santalum album</i>.
 ‘Irul—<i>Xylia dolabriformis</i>.
 ‘Vēnga—<i>Pterocarpus Marsupium</i>.
 ‘Thēmbāva—<i>Terminalia tomentosa</i>.
 ‘Ven Teak—<i>Lagerstroemia lanceolata</i>.
 ‘Meili—<i>Vitex altissima</i>.
 ‘Pūvan—<i>Schleichera trijuga</i>.
 ‘Vekkali—<i>Anogeissus latifolius</i>.
 ‘Mullu Vēnga—<i>Bridelia retusa</i>.
 ‘Ven Marutha—<i>Terminalia paniculata</i>.
 ‘Thāni—<i>T. belerica</i>.</p> | <p>Nay Thēkka—<i>Dillenia pentagyna</i>.
 Nux Vomica—<i>Strychnos Nuxvomica</i>.
 Gallnut—<i>Terminalia chebula</i>.
 Uthi—<i>Odina Wodier</i>.
 Kumbil—<i>Gmelina arborea</i>.
 Pēra—<i>Careya arborea</i>.
 Nelli—<i>Phyllanthus Emblica</i>.
 Vāga—<i>Albizia procera</i>.
 Mūra—<i>Buchanania latifolia</i>.
 Chinna Kadamba—<i>Stepegynia parvifolia</i>.
 Mala uthi—<i>Stereospermum xylocarpum</i>.
 Murukka—<i>Erythrina indica</i>, and some others.</p> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

'These forests suffer much from grass fires which become yearly more intense as the trees are felled, and the grass is thus encouraged to grow, while the branches and tops of the logs left about feed the flames.

'The *fourth* class of forest is, of course, worthless, as far as timber is concerned."

The area of forest land in Travancore is superintended partly by the Conservator of Forests, partly by the Superintendent of the Cardamom Hills. The areas under either are, in square miles :—

	<i>Cons. of Forests.</i>	<i>Supt. of Cardamoms.</i>
Moist forest	... 980 $\frac{1}{4}$	221
Secondary forest	... 442 $\frac{3}{4}$	140
Grass forest	... 504	42
Useless land	... 209	505
	... 2,136	908

Total ... 3,044 sq. miles.

The Report goes on to give a minute and very interesting description of the practice of 'Shifting cultivation,' which in Travancore is called 'Virippu' or 'Malam Krishi' and then proceeds to describe the chief timber trees of which 23 are enumerated and described in detail.

These are :—

1. Teak	<i>Tectona grandis</i> , Linn. f.
2. Blackwood	<i>Dalbergia latifolia</i> , Roxb.
3. Ebony	<i>Diospyros Ebenum</i> , Kön. or <i>Melanoxylon</i> , Roxb.
4. Sandalwood	<i>Santalum album</i> , Linn.
5. Anjili	<i>Artocarpus hirsuta</i> , Lamk.
6. Kambogam	<i>Hopea parviflora</i> , Bedd.
7. Venga	<i>Pterocarpus Marsupium</i> , Roxb.
8. Themboak	<i>Terminalia tomentosa</i> , W. and A.
9. White cedar	<i>Dysoxylon malabaricum</i> , Bedd.
10. Red cedar	<i>Cedrela Toona</i> , Roxb.
11. Ven teak	<i>Lagerströmia lanceolata</i> , Wall.
12. Jack	<i>Artocarpus integrifolia</i> , L.
13. Irul	<i>Xylia dolabriformis</i> , Bth.
14. Mayila	<i>Vitex altissima</i> , L. f.
15. Manjakkadambu	<i>Adina cordifolia</i> , Hk. f.
16. Púvan	<i>Schleichera trijuga</i> , Willd.
17. Mainmaruthu	<i>Lagerströmia Flos-Reginæ</i> , Retz.
18. Mango	<i>Mangifera indica</i> L.
19. Punna	<i>Calophyllum tomentosum</i> , Wight.
20. Chini	<i>Tetrameles nudiflora</i> , R. Br.
21. Pathiri	<i>Stereospermum xylocarpum</i> , Wight.
22. Ilavu	<i>Bombax malabaricum</i> , De.
23. Karunthagara	<i>Albizzia procera</i> , Bth.

but many others of use and value are mentioned and an appendix contains a full list of the trees of Travancore which is a most valuable work, compiled as it is by an officer of such well-known botanical knowledge and experience as Mr. Bourdillon.

We could not hope, in the limits of a review in these pages to do anything like justice to the information afforded, but we venture to quote the following on the teak tree and its distribution in Travancore as a sample of the pains taken to describe it accurately :—

“*Tectona grandis*, Linn. fil., English : teak, Tamil : thēkku. Malayalam : thēkka. The teak tree belongs to the order Verbenaceæ. Its appearance is so familiar to every one in South India that it need not be described here, further than to say that the leaves are opposite, about 10 or 12 inches long, and nearly as broad, rounded, and with a pale under side. The foliage is sparse, and the whole of it falls at the same time, once a year in the hot season, leaving the branches bare. The teak tree flowers in June and July, and its fruit ripens in the dry weather, January to March. The flowers are white, about $\frac{1}{2}$ inch in diameter, and are clustered in large bunches at the ends of the branches. The fruit consists of a nut enclosed in a spongy covering, which is further enveloped in the enlarged calyx, a loose case of one inch or more in diameter. The nut contains normally 4 seeds, but 2 or 3 are usually abortive, so that not more than one or two plants grow from each fruit. The only tree which is sometimes mistaken for teak is the *Dillenia pentagyna*, Tamil : nay-thēkku, Malayalam : koda-punna, whose large leaves somewhat resemble the leaves of the teak, but on closer inspection the former can easily be distinguished by their pinnate venation, and their serrated or jagged outline, while the veins of teak leaves are distant, and their edges are regular. The flowers and fruit of these two trees are quite dissimilar.

‘The teak tree is indigenous in south-western and central India up to 25° north latitude and in Burma, Pegu, Java and Sumatra. In other parts of India north of 25°, it is cultivated, as in Bengal, Assam, Sikkim and the North West Provinces, and it has been introduced into Ceylon, but it is not indigenous in those countries.

‘Teak grows best in a temperature ranging between 60° and 90°. It can bear cold greater than that indicated by these figures, but under such conditions it does not attain large dimensions. As regards moisture, the annual rain-fall should be not less than 50 nor more than 150 inches, and if there is a long period of dry weather, teak, owing to its habit of wintering and its ability to stand drought, will be found to form a larger proportion of the forest trees than if the rain-fall were more evenly distributed through the year.

'The teak tree grows from sea level up to 3,000 ft. or in some cases to 4,000 ft. but in Travancore the former altitude is its highest limit, and, at this height, it does not thrive so well as a little lower down. The most suitable aspect is south west.

'Teak is found growing in all kinds of soil and in various localities, on sand-stone, granite, and lime-stone, on the steep hill sides, and on the alluvial land on the river banks. But, as Dr. Brandis* points out, "under all circumstances there is one indispensable condition, perfect drainage, and a dry subsoil." When it occurs on a hard subsoil through which its roots cannot penetrate, the rapidity of its growth diminishes after a certain time, and the annual increment of its volume is very small. Under such conditions it becomes a question whether it is not better to fell the trees at an early age, as the yearly growth attained does not compensate for the loss of time.

"It is only in open forests of deciduous trees that teak is met with. During the hot weather it loses all its leaves, and growth ceases for a time. If it were found near evergreen trees which do not winter in the same way, and which retain their vitality and power of growth throughout the year, they would take advantage of its period of inactivity and would occupy the land to its exclusion. Thus, teak is only seen in company with bamboos, or with trees that winter in the same way as it does, or are not aggressive, such as *Dalbergia latifolia*, *Pterocarpus Marsupium*, *Terminalia tomentosa*, *T. paniculata*, *Anogeissus latifolia*, *Schleichera trijuga*, *Gmelina arborea*, *Sterospermum xylocarpum*, *Careya arborea*, *Phyllanthus Emblica*, and others.

'In Travancore, the teak is usually found on the lower slopes of the hills and at their feet, for here the extent of evergreen forest is small. Farther inland, such forest occupies all the valleys, and the teak is driven up the hill sides, where the soil is too dry to support evergreen trees.

'In certain situations, this tree often forms the greater part of the forest, purely, I believe, because it can stand a drought greater than would suit any other tree. But even teak does not thrive on slab-rock with a covering of about a foot of mould over it, and in such situations it does not attain a large size, but the trees often grow very close together. Such trees are called kōl-teak.

'I have endeavoured without success to ascertain the derivation of this name. †The word kōl may mean a stick or pole of any sort, or it may mean the particular measure used for calculating the dimensions of timber. Thus, kōl-teak may be either saplingteak, or teak of such small size that only a kōl length of timber can be cut from it. Neither derivation exactly

*Forest Flora of N. W. Provinces, pp. 356.

† It has been suggested to me that kōl-teak may be teak whose circumference is less than one kōl.

‘agrees with the ordinary acceptance of the term. In the
‘proclamation of 1853 kōl-teak is defined as teak under 10
‘vannams—(12½ inches) quarter girth, but this manifestly
‘includes, not only all old stunted trees that would never attain
‘larger dimensions, but also all young trees that certainly would
‘be larger. Again, the Report of the Forest Commission in 1884
‘(para 15) defines kōl-teak as “teak growing in poor soil and in
‘the open country,” and this properly defines it, but does not
‘explain the derivation of the term. Kōl-teak is teak growing in
‘unfavourable situations, such as on laterite, or on rock with very
‘little surface soil, and, in consequence, so stunted that it would
‘never attain large dimensions however long it lived, would never
‘in fact be more than a pole.

‘The greater part of the teak found in the low country is
‘kōl-teak because there is so much laterite and rock on the dry
‘hills, but the kōl-teak of North Travancore, growing on laterite,
‘is much finer than the kōl-teak of South Travancore which grows
‘upon a stratum of rock. Some good teak of large dimensions is
‘seen in the low country, whereas on the banks of rivers the
‘soil is deep and fertile.

‘On account of its slow growth, kōl-teak has usually a dif-
‘ferent appearance to the fast grown teak of the better land. It is
‘darker in colour, contains more oil, and is considerably heavier.
‘This has led some people to speak of it as a species distinct from
‘ordinary teak, and to call it “bastard teak.” This is quite a
‘mistake.

‘The finest teak in Travancore is to be found on the hills at
‘at an elevation of from 1,000 ft. to 2,000 ft. The Idiyara valley,
‘the sides of which run up to more than this elevation, used to
‘be celebrated for the quantity and size of its teak. Dr. Balfour
‘in his “Timber Trees” mentions that a Mr. Edye, about the
‘beginning of the century felled a tree in this valley seven feet
‘in diameter at its base, and 26 inches in diameter at 70 ft., from
‘its butt. This would give about 58 candies, or 900 cubic feet of
‘timber. In the Trevandrum Museum there is a plank sawn from
‘a tree felled in the same valley which is 4 ft. 3½ in. across.
‘The conditions to be found in the Idiyara valley are peculiarly
‘favourable to longevity. The teak tree is there seen growing
‘in thickets of the éetta reed (*Beesha travancorica*), and it there-
‘fore does not suffer from fire as would be the case in grass land.
‘The soil also is very fertile, and the climate forcing, while there
‘are no violent winds. Thus those trees which, in other places
‘and under less favourable conditions, would be burned or blown
‘down, continue in this valley to grow, adding on a small incre-
‘ment to their size year by year.

‘It is particularly important to remember that this large
‘size is not due to rapidity of growth, but to great age.

*The plank I have mentioned as having been deposited in the Trevandrum Museum, shows 156 rings, and at least 50 more would appear if the plank had been sawn from the centre of the tree. These concentric rings, which indicate the age with exactness, are in this plank never more than $\frac{1}{4}$ inch apart, and sometimes two consecutive rings are no more distant from each other than the thickness of a piece of note paper. This tree therefore must have been well over 200 years of age, and Mr. Edye's seven foot tree must have been a veteran of 4 centuries.

The Idiyara valley and all the accessible forests of Travancore have been worked for teak for at least a century, and, knowing this, it is not surprising to find that there is little or no large teak left anywhere in the country except in very out of the way places, from most of which it will never pay to remove the timber. Of third class and kōl-teak there is a fair quantity.

I estimate the total number of standing teak trees of good size, that is of the first, second, and third class above 8 virals (10 inches) quarter girth as 100,000 and of kōl-teak and smaller trees at about 400,000. I refer to timber that can be brought down at a profit, and I do not include such as grows on the Periyar above Karimanal, and is inaccessible, saving what can be taken to Ramakkal or Kumili. These trees are scattered over about 400 square miles of country.

The number of teak logs sold by the Forest Department every year is not less than 12,000, (of which about 2,000 are below 8 virals quarter girth) if we include those sawn up and delivered at the depôts of Shencottah, Quilon, &c. by contractors. There are also some 10,000 sleepers annually sold to the Bombay firms. Comparing these figures with those already given as showing the number of standing trees left in the country, it will be seen that the supply of good-sized timber at the present rate of consumption will be exhausted in about ten years, leaving nothing but immature and inferior wood. Besides this, there is a supply of felled timber lying in the forest sufficient for about two years.

That the quantity of teak still remaining in Travancore is very small, is well known to everyone who has anything to do with the forests. The present Conservator, Mr. Vernède, is well aware of this state of things, and has more than once noticed it to me, and in his Annual Reports for the last 5 years, as well as in former years, has urged the necessity of extending the plantations, in order to counterbalance the drain on the forests of the country by the annual felling of so many trees. To any one resident for a short time in one place, though knowing

*In a pamphlet by Mr. Bryce of the Bombay and Burmah Trading Co. upon teak, he says "In a tree 8 ft. in circumference, I have counted 380 rings of annual growth, so that the great trees of 6 ft. diameter must have reached an age of several thousand years."

'nothing of our forests, the rapid disappearance of teak from some parts is very apparent, and I have been frequently told that in such and such places the tree has been almost exterminated in a very short time.

'Another proof of the growing scarcity of the timber is the increased cost of working it to the depôts, the contractors now refusing to undertake any contracts except at higher rates than formerly. If the quantity felled was not in excess of the annual reproduction, the contract rates should be less than formerly, for the contractors now have roads and means of exploiting their logs which were not available to them before.

'The question of the rate of growth of teak as bearing on the profits to be expected from plantations is one of the greatest importance. As the result of many experiments, it has been proved to a certainty that the concentric rings seen so markedly in teak wood exactly indicate the age of the tree, one ring being added on each year. In his *Manual of Indian Timbers*, Mr. Gamble gives the diameter measurements of 29 trees with the number of rings in each, showing that the average width of a ring of wood is nearly half an inch, that is to say 2.62 rings go to the inch of radius: in other words teak increases at the rate of an inch in diameter in 1.3 years.

'I have made measurements of a great number of trees growing in the forest, and I find that the average increase is certainly not more than $\frac{1}{4}$ inch of radius in a year, that is to say that the increase in diameter is 1 inch in 2 years, and it is usually much less. I find that, as a rule, unless the soil is particularly rich and deep, the rate of growth of the tree, which is rapid up to 40 years of age, sensibly diminishes after that time. Under ordinarily favourable circumstances, at 40 years old a teak tree should be 20 inches in diameter at 2 ft. from the ground, excluding the bark, and 25 inches at 60 years. These figures would show that the growth of teak is not so rapid in Travancore as it is in other parts of India, but Mr. Gamble admits that his measurements were taken from particularly good specimens grown in plantations, and Dr. Brandis says that it generally takes a teak tree 100 years to attain a girth of 6 ft. at 6 ft. from the ground. The growth here may therefore be considered as much the same as it is elsewhere. As a matter of fact, the logs of 20 and 25 inches in diameter delivered at the depôts are more than 40 and 60 years old respectively, being probably double that age, but they have been exposed to forest fires, and have been distorted and retarded in growth accordingly.

'As to the age to which trees may live, all depends on the character of the soil and the conditions that affect them. Under favourable circumstances, teak will live and go on growing slowly for 400 years or even more, but this is exceptional, and as the annual increment at an advanced age is small, most trees fall to the axe between 60 and 100 years old by which time they should be about 2 ft. in diameter.

‘ Although the teak tree, compared with some other trees, does
 ‘ not increase much in diameter from year to year, it shoots up
 ‘ vertically with very great rapidity. Under favourable circum-
 ‘ stances, it will rush up 10 ft. the first year, and 5 ft. a year for the
 ‘ next 10 or 11 years. So that at 12 years old it is 70 ft. high,
 ‘ and 6 inches in diameter. After that the tree makes but little
 ‘ upward growth, but continues to increase in diameter with great
 ‘ regularity.

‘ The ash of teak timber forms only about 1 per cent of the
 ‘ weight of the wood : this tree therefore exhausts the soil to a
 ‘ very slight degree. Of this 1 per cent., .22 of the ash consists of
 ‘ magnesia, .27 phosphoric acid and .33 of silicic acid, the other
 ‘ constituents of the ash of plants including potash, soda, and
 ‘ lime being poorly represented.

‘ The weight of teak when freshly cut is about 55 lbs a cubic
 ‘ foot, and 40 lbs when thoroughly dried ; so that the wood
 ‘ floats easily after being well seasoned, but large logs take 2 or 3
 ‘ years before they have parted with their moisture. The value of
 ‘ P is set down at 600, so that for cross strains teak is not so strong
 ‘ as many other timbers, as blackwood for instance. The great
 ‘ value of teak lies in the fact that it does not warp or twist, that
 ‘ owing to the essential oil found in it, it is not eaten by white ants,
 ‘ and that it possesses a straight grain, and is easily worked, and
 ‘ finally that it can be obtained of large size.

‘ These numerous good qualities make it available for a great
 ‘ number of purposes, and teak is probably the most generally
 ‘ useful wood in the world. For shipbuilding and the backing of
 ‘ ironclads it stands unrivalled, on account of its great powers of
 ‘ resistance. It is very extensively used for railway carriages, for
 ‘ house building, and for furniture of all kinds, and lastly, it is em-
 ‘ ployed in the construction of bridges, and other works in the open
 ‘ air. As, in our moist climate on the west coast, teak wood does
 ‘ not maintain its strength more than 7 or 8 years, it seems to me
 ‘ a waste to expose this valuable timber, which is already becoming
 ‘ scarce, to the destroying influences of sun and rain, when if kept
 ‘ under cover, it would probably last for hundreds of years.

‘ Teak now sells in Travancore at from Rs. 10 to Rs. 17 a candy,
 ‘ or say 10 annas to Re. 1 a cubic foot. Elsewhere, the price is at
 ‘ least double this, but Travancore teak is now-a-days mostly so
 ‘ small and so much damaged by fires, which cause heart and radial
 ‘ shakes, or by borers, that it is less valuable than the same wood
 ‘ grown in other countries.

‘ Teak found in the low country of Travancore suffers much
 ‘ from a borer which tunnels irregular holes of the diameter of a
 ‘ lead pencil in different directions through the wood. This boring
 ‘ is entirely due to the abominable system of lopping the leaves
 ‘ of this tree for manuring paddy fields. In May and June,
 ‘ when the teak is in full growth, the owners of the neigh-
 ‘ bouring paddy lands strip the trees of all their leaves,

‘leaving but snags all the way up the stem, and a tuft of a few leaves at the top. If this lopping were performed in the dry weather, when the tree was resting, the damage might not be great, because the branches which had been cut back would then possibly sprout again when the season of rest was over, but as the lopping is practised when the trees are in full growth, the sap, trying to find an exit, instead of forming buds at the ends of the branches, expends itself in sprouts thrown out from the sides of the old branches which then die back: and, as this lopping goes on year after year, a large extent of dead wood is left in the places where the old shoots once grew, all up the tree. This dead wood is seized on by a certain species of moth, which Mr. Cotes of the India Museum, Calcutta, thinks to be identical with the coffee moth (*Zenzera coffæophaga*), as a place of deposit for its eggs and from these eggs the borers hatch out and tunnel into the wood, which in bad cases thus becomes thoroughly riddled, and is then quite useless for any purpose except for rough out-of-door work, posts and so on. These borers may be found in the lopped teak trees any time between June and the following February, after which they pupate, and finally, the perfect insect emerges about one year after the egg which originated it was laid; but this requires further confirmation, as I have not been able to thoroughly trace the successive stages of its growth. That the lopping of the trees is entirely answerable for this great destruction of valuable timber can easily be proved, for no signs of any such boring are ever to be seen in trees growing in the forest at a distance from cultivation, and which are therefore not lopped. The annual loss to Government must amount to many thousands of rupees, all of which could be saved by prohibiting the baneful practice of lopping.”

Each of the principal trees is thus described with a great quantity of new and valuable information regarding them and their habits and silviculture. Sandalwood is only found in Travancore in the Anjináda valley in the extreme North-West of the State. Of Blackwood and ‘Vengai’, it is said that all that is necessary to ensure their good reproduction is to keep down the grass fires. White cedar is used in the construction of casks to carry cocoanut oil. *Adina cordifolia* wood is used in turning and can be recommended to those of our readers who suffer from insomnia because “bedsteads made of it are said to have a very soporific effect.”

It would take too long to quote even a portion of the interesting information given, so we will content ourselves with the following extract regarding the bamboos:—

“Of bamboos and grasses, the most useful is the ubiquitous ‘bamboo’ *Bambusa arundinacea* (Retz) called by the people ‘mūngil,’ ‘mula,’ and ‘illi.’ Its uses are too well known to need description. It dies down at intervals of from 25 to 30

years, and 8 or 10 years must elapse before full sized culms can be obtained. A general seeding occurred in South Travancore when Lient. Ward was travelling through the country in 1817, and another in 1870. This last was confined to the area south of the Acchankōvil river. North of this river, the seeding occurred about 1879-80, and it has been impossible to get full sized bamboos in North Travancore ever since. The male bamboo, or "kal mungil" *Dendrocalamus strictus* (nees) is, to my knowledge, only found in Travancore in the Anjināda valley at an elevation of about 3,000 feet. Its almost solid culms are used for carriage shafts, spear handle and other purposes. A species of thornless bamboo which Mr. Gamble has called *Oxytenanthera Bourdillonii* is found only on the hills at elevations over 3,000 feet, and there only growing on rocky cliffs. It is known to the Hillmen as "pon mūngil," "kāmbu," and "arambu." This bamboo attains a diameter of only about 4 inches, but the internodes are unusually long, and the walls of the culms are very tough. The Hillmen use it for making combs and other household implements. It is said to flower only at long intervals and did so in 1888-1890. The "ēetta" or "irūl" reed *Beesha-travancorica* (Bedd) forms the undergrowth of our forests over immense areas in different parts of the country and near the crest of the hills it often occupies the whole of the ground, covering the slopes with dense and almost impenetrable thickets. Its presence is generally indicative of free but poor soil. Land that has been cleared for hill cultivation and has been abandoned, often becomes covered with thickets of this reed, though, before the clearing was made, there may have been only a few clumps of it growing in the forest. The Hillmen use this *Beesha* largely for their temporary huts, the reeds themselves being employed for the frame work, and the leaves to thatch them. The reeds are also much used for fencing, basket making, mats, &c. An excellent paper is made out of the fibre. The Hillmen recognise two species of this reed; they have not been scientifically distinguished, but further investigation will probably prove this to be the case. This *Beesha* seeds once every seven years. The "amma" reed, *Beesha Rheedii* (Kunth) which is found along the river banks in the low country, is used for basket making. Another reed, *Teinostachyum Wightii* (Munro) is found on the hills. It is supposed to flower at long intervals and did so on Peermerd in 1887-1889. Other reeds, not yet identified, are indigenous on the higher hills. Of grasses, the most important is the lemon grass *Andropogon schœnanthus*, from which an oil is extracted. As time goes on, other kinds will probably be found, useful for the manufacture of paper, and for various purposes."

The third chapter gives a detailed account of the history of the forests, which begins with the time 1817 to 1820, the first

Conservator having been a Capt. Robert Gordon. He was succeeded one by one by Mr. U. V. Munro, Mr. West, Mr. Kohlhoff and Mr. Vernède, the present Conservator having taken office on the retirement of the last-named in 1891. The old systems of management are then described, as is the work of capturing wild elephants which in Travancore devolves on the Forest Officers.

In Part II follow the 'suggestions for future management,' which begin by an interesting account of the importance of forests and of forest conservancy, go on to consider the comparative advantages of natural and artificial regeneration and those of the different systems of working. In regard to these, the conclusion arrived at is that the *selection* system is the one which it will be best and safest to adopt.

The staff which is recommended for Travancore is

	Rs.
1 Conservator Rs. 700 to 1,000 with Rs. 150 batta	... 1,000
2 Deputy Conservators and 1 Superintendent of Surveys	
Rs. 350 to 550 with Rs. 100 batta	... 1,650
3 Assistant Conservators Rs. 150 to 250 with Rs. 60	
batta	... 780

with 6 Rangers @ Rs. 100, 8 Foresters @ Rs. 40, 14 Clerks @ Rs. 10 and 100 Peons and Forest Guards. @ Rs. 9.

In regard to *Finance*, it is demonstrated that hitherto the revenue has been obtained at the expense of the capital of the forests and that consequently there may be for some years a reduction in the usual yearly surplus of 3 lacs. We strongly recommend the whole Report to our readers and consider that Mr. Bourdillon, who deserves the greatest credit for it, ought to have it or at any rate the greater part of it, reprinted in a convenient size as a Forest Manual for Travancore. We congratulate him on his work and hope that the Government of His Highness the Maharaja will assist him to carry out to the full his plans for the forests of the State.

Reports on the Gardens at Saharanpur and Lucknow for 1893-94.

As usual, the Saharanpur Gardens paid their expenses during the year : they even went further and gave a surplus revenue of Rs. 947. The attempt to make the gardens financially successful has been, however, a success only at the expense of their condition as a resort, as was abundantly evident last year, for the tangled and jungly condition of the growth in the shrubberies, the weed-over-grown ponds and the dilapidated roads shewed only too clearly that financial considerations were paramount. We are

glad, however, to learn from Mr. Gollan's Report that this is to be gradually remedied and that already some improvement has been effected. The chief business of the Garden is the raising and sale of fruit trees, the growing of flower and vegetable seeds, chiefly for soldiers' gardens, and the propagation of medicinal drugs, such as *Hyoscyamus*, *Taraxacum* and Jalap. Among fruits which have been successfully grown, the American Dewberry is noticeable. This plant, the *Rubus trivialis*, is a small ground trailer with a fruit like a cross between a raspberry and blackberry, it is quite successful in Saharunpore, as it is in Dehra Dun. It is best used for making jam. The edible date plantation is flourishing except that some of the plants have been attacked by the beetle *Rhyncophorus ferrugineus*. Both the Director of Agriculture and the Government of the N.-W. P. and Oudh bear testimony to the excellent work done by Mr. Gollan.

The Lucknow Gardens very nearly pay their expenses and on them the Government Review says :—

“ They are beautifully kept and considering the high standard of excellence maintained from year to year it is not surprising that there should be a loss on their management.” In the Report, however, there is not much to note which will interest our readers. The only species of *Eucalyptus* which seem to thrive are *E. tereticornis* and *E. citriodora* which are also the only two which have proved capable of growing well in Dehra Dun. The wood of the latter is being tried in the Central Prison. As with Mr. Gollan, Mr. Ridley's efforts have met with favourable notice from the Government.

VI.-EXTRACTS, NOTES AND QUERIES

A Forest Reunion in France.

The *Revue des Eaux et Forêts* for September last contains a notice of the fourth visit of the Coopers Hill Forest Students to Mortagne and the neighbouring state forests of the Perche, Reno-Valdien and Bellém. Twelve students of the junior class under Mr. Fisher, professor of Sylviculture, were accompanied by Messrs Young and Hearle, Deputy Conservators on furlough, the latter being, as is Mr. Fisher, an old student of the Nancy Forest

School. The French Forest Officers who accompanied and made all arrangements for the party were M. Charlemagne, Conservator, Le Levreur Inspecteur, and Belliard Garde General.

The class spent some days in studying the various forests, parts of which were much admired, notably the high forest of Port-à-la-Dame where the oaks attain a height of 40 metres with trunks capable of giving a length of 32 metres of timber. The class respectfully saluted one of the finest of these trees called Tregomain's Oak in honour of the Inspecteur of this name who passed 15 years of his service in this forest and who has rendered considerable assistance to the Coopers Hill Students on several occasions. This courteous salutation of Tregomain's Oak would therefore, we doubt not, be thoroughly appreciated by the local officials.

The students also witnessed the operation, necessary in these forests, where trees are so enormous, of removing the branches or crown of an oak previous to felling. The crown comes down with a frightful crash, its fall causing a violent oscillation in the trunk left standing which is described as giving one the impression that the trunk is endeavouring to shake off the enemy attacking it. The enemy however hangs on to its sides by the aid of his rope and climbing irons. The profession of decapitator is a paying one and necessarily somewhat dangerous; the operator who performed before the English class completed his work successfully in spite of his 72 years, and having finished the operation, he seated himself in triumph on the cut cross section about 20 metres above the ground and there according to the custom of the times was photographed by one of the students.

Subsequently, the class visited and studied the forest of Lyons in which the Beech is the principal species and there the various works and provisions of the Working Plan were fully explained by the Forest Officers of the Lyons "inspection."

After visiting the forests, Mr. Fisher invited the whole party to dinner, at which entertainment the greatest cordiality and gaiety prevailed. Mr. Fisher toasted the French Forest Officers, M. Leguay the Conservator of Rouen in replying referred to the strong feeling of "camaraderie" existing between the French and English Foresters. Mr. Hearle expressed in eloquent and descriptive language his admiration for the forest of Lyons and his recognition of the kindness and consideration with which the visitors had been received. Finally M. Boisset, the Mayor of Lyons, who was also of the party, drank to the health and success of the students, who then speeded the parting guests "aux cris de hip, hip, hip, hourra."!!

It is pleasant in these days of political bickering between the two nations, to find that the 'Foresters' of either can sink their national jealousies and meet in cordial friendship in the forests.

Mixed Oak and Beech Forests of the Spessart.

The vivid sketch of the magnificent hardwood reserves still remaining in the states south of the Ohio River, by Dr. Charles Mohr, of Mobile, which appeared in *Garden and Forest*, Volume VI, p. 21, has called to my mind the wealth of old standing oak timber in the Spessart, one of the most interesting mountain-ranges of central Germany. North American forests contain a great variety of species, whereas the forests of which I am speaking consist of two kinds only, the beech, *Fagus sylvatica*, and the oak, *Quercus sessiliflora*, the former being replaced in valleys and on low ground, exposed to night frosts, by the hornbeam. *Carpinus Betulus*. The birch, maple, lime-tree, ash and wild cherry are very rare, and besides these there are only a few soft-wooded trees here and there, like the aspen and willow. Conifers have, it is true, been introduced on a large scale during the present century, and the groups of larch, the woods of Scotch pine and spruce give a greater variety to the forests. but they are not indigenous in the Spessart. Again, forest trees in this portion of Germany are considerably smaller than in most of your forests. The rich soil of the valleys in the Alleghanies is said to produce yellow poplar trees 200 feet high with a trunk diameter of over ten feet whereas the tallest oak in the Spessart does not exceed 150 feet with a diameter of five feet. But, however different the aspect of forests on the two sides of the Atlantic may be, they have a point in common, the more valuable hard woods are associated with other species of little or no commercial value. In both cases, therefore, the forester has to address himself to the same difficult task, to work the forest in such a manner as not to diminish, but rather, if possible, to increase, the proportion of the more valuable kinds. An account of some of these German forests and the approved methods of regenerating them ought, therefore, to be instructive to American readers.

SPESSART—GENERAL DESCRIPTION.

The Spessart selected for illustration is in Franconia, its highest point, the Geiersberg, being 1900 feet above sea-level. The prevailing rock is new red sandstone, and the hills have rounded outlines, mostly with gentle slopes. The soil is a light, sandy loam, of itself not very fertile, but fortunately enriched by a large admixture of vegetable mould, the result of uninterrupted forest growths during thousands of years. This soil, where deep, is capable of producing tall cylindrical well-shaped stems. From the top of the Geiersberg the surrounding country present itself as

a boundless sea of forest, clothing ridges and valleys almost without a break. Villages there are, but they are not numerous, and most of them are down in the valleys, and therefore concealed by the tall woods which surround them. In June, the tender, light-coloured leaves of the beech form marked contrast with the darker foliage of the oak. The picture is varied by black patches of spruce, by the bluish green of the Scotch pine, and here and there the tops of tall larch trees stand out from the rest readily distinguished by the brilliant light green of their new leaves. Game is plentiful. If you start early in the morning you are sure to come across numbers of red deer; and wild pig, with their young, are often seen. The forest is dense and unbroken, except where fields surround the villages and narrow bands of meadows skirt the streams in the valleys.

The light sandy loam which overlies the red sandstone owes its fertility mainly to the accumulation of vegetable-mould. Unfortunately, however, a practice prevails in the greater portion of this forest district which seriously interferes with this accumulation of vegetable-mould. This is the removal of litter—the fallen leaves which cover the ground. The soil around the villages is poor, and must be manured heavily. The area of the fields is limited, and so are the meadows. Root crops can only be grown to a small extent, and the cattle must largely be fed with straw. Hence forest litter is indispensable, but by its removal, the ground gets denuded, the soil is impoverished and the forest growth suffers. Originally this practice was permitted, because the population was scanty and its hurtfulness was not fully realized. Gradually population increased, and the practice being continued unchecked, a right was acquired by prescription, and when in 1814 the forest was incorporated with the kingdom of Bavaria there was no help for it but to acknowledge the right and to regulate its exercise so as to limit the damage to the forest as much as possible.

The collection of litter has been regulated in this wise. It must not be exercised in young woods which have not yet attained half the age prescribed by the term of rotation; further, an area where litter has been collected, must have at least six years' rest before it is again opened for that purpose, and lastly, the areas open for the collection of litter must be assigned annually by the responsible forest officers, and this is done in accordance with a well-considered plan. Nevertheless the quantity of leaves removed annually is enormous. In spring and autumn long strings of wagons filled with huge mountains of litter leave the forest in every direction, and the result is that the soil does not improve as much as it might, and in places it is much impoverished.

The state forests in this part of Bavaria are also burdened with the right to dry wood, which may be exercised twice a week by the neighboring villages. May, June and July are excepted,

and on the first open day in August, long before daybreak, thousands of carts and wagons enter the forest from all sides to fetch the dry wood, which is much prized, not as fuel only, but also for agricultural implements, etc. The forest is alive with men, women and children collecting what is on the ground and cutting dry standing trees. On these days the foresters have their hands full in guarding against injury to green trees. All dry wood down to three and a half inches diameter belongs to the right-holders, who may use the dry wood removed by them, but may not sell it.

Dry wood such as is removed by right-holders, is the outcome of overtopped and suppressed trees. Naturally, these are most numerous in crowded woods, whereas they are scarce in forests subject from an early age to a regular system of periodical thinnings. Hence the rule has been laid down, in order not to curtail the supply of dry wood to right-holders that no thinnings shall be made until the woods have attained half the age which they are destined to attain.

Another forest-right, but of less moment, is pannage, or the right which the inhabitants of certain villages have to feed swine upon the beech and oak mast within the forest. The exercise of this right, however, is suspended on the occurrence of a good oak mast from October to January. During that period the pannage is sold to the highest bidder, payment being generally made by the delivery of acorns collected in the forest, to be used for the extensive plantations of oak made annually by the forest Officers.

VALUE OF THE OAK.

In the Spessart, as throughout Germany, the most valuable tree is the oak. The beech and the hornbeam are useful companions; nay, they may be said to be necessary for the good development of the oak, but the value of their produce is small. An oak-tree, twenty-four inches in diameter, breast-high, and 104 feet high, will yield 5 cubic metres, or 176 cubic feet, of saleable wood, including pieces down to three inches in diameter. If sound, it will sell as follows:—Logs, fifty-five per cent. or 2.75 cubic metres at fifty marks a cubic metre, 137.50 marks. Small timber, chiefly for wine-casks, twenty per cent or 1 cubic metre at fifteen marks. Firewood, twenty-five per cent or 1.25 cubic metres at 3.50 marks, 4.38 marks. The whole worth 156.88 marks.

A beech-tree of the same size will sell as follows: Timber thirty marks; firewood, seventy per cent for 18.50 marks, or 47.5 altogether. The timber of the hornbeam sometimes fetches a little more than beech, but the tree grows more slowly and never attains the same size as the beech. Thus assuming a dollar as equivalent

to four marks, an oak-tree of the size mentioned would sell for thirty-nine dollars, and a beech-tree for twelve dollars. It must however, be borne in mind that, while an oak-tree of that size would be 300 years old, a beech-tree in the same locality would attain the same dimensions in 130 years. Many of the oak-trees in the Spessart are 400 years old and upward, and have a much larger diameter, often containing twice the volume of wood. The price of oak timber increases considerably with the diameter of the tree, large logs not rarely fetching 100 marks per cubic metre. Such trees would be worth \$125 to \$150 apiece, or even more. Of oak containing five cubic metres, on good soil and under favourable circumstances, sixty trees might stand on one acre. The outturn of an acre at the fall, therefore, would be worth sixty by thirty-nine or \$2,040, while the wood of an acre stocked with beech of the same size would only be worth \$720. This result, however, would be attained in 180 years, whereas the oak wood would be 300 years old.

These figures will make it clear that of the trees indigenous in the Spessart, the beech far preponderates, its growth is more vigorous and faster than that of the oak. Hence, in working the forest, the tendency will always be for the beech to gain the upper hand and for the oak to disappear. This will explain sufficiently why it is necessary to make special efforts to frame the plan of working the forest, so as gradually to increase the proportion of oak in it.

PRESENT GROWING STOCK OF OLD OAK TREES.

From time immemorial, the Spessart has been one of the principal sources of large oak timber in Western Germany. The rich wine-producing districts in the valleys of the Rhine and the Main have chiefly depended upon these forests for their wine-casks. And for boat-building and house-building the Spessart has always furnished a large quantity of oak. In spite of these constant and heavy demands, large numbers of old oak-trees from 240 to 500 years of age still remain standing. These old trees are mostly found scattered in the old beech-woods, but there are some areas where the oak forms a large proportion of the growing stock. The most remarkable of these is situated in the forest-range of Rohrbrunn, on the North-West slope of the Geiersberg, which, as already mentioned, is the highest point of this mountain-range. Here there are upward of 1,000 acres in one block, stocked with oak 240 to 245 years old at the rate of seventy trees per acre, the trees eighteen to twenty inches in diameter and ninety-five feet high. Among the oak, here and there, are a few beech-trees, and the ground is everywhere covered with an underwood of beech, partly natural, partly planted. These oaks date from the middle of the seventeenth century; they sprung up soon after the

thirty years war (1618-1648), and some of the mother-trees are still left, giants 500 years old, with a diameter of forty inches. This is not rapid growth, but the elevation is high 1,300 to 1,700 feet, and the soil on this slope is not very deep and not very rich.

That this is slow growth will be understood from the following figures: A survey made in August 1891 of a sample area, six-tenths of an acre, selected as a good average, gave ninety-one trees per acre, mean height ninety-five feet, tallest tree 105 feet and 8,087 cubic feet, equal to 97,000 superficial feet of timber-oak, pure, it will be remembered, with an underwood of beech, which, of course, was not included in the survey, at an elevation of 1,500 feet. In Normandy, at a low elevation, on rich soil in a mild and uniformly moist climate, there is a wood of sixty-eight acres, in the forest-range of Lyons-La-Forêt, consisting of beech sixty-five per cent, oak and hornbeam thirty per cent, and other species five per cent; sixty-eight trees per acre; mean age, 160 years, with some old standards up to 240 years old; mean height, 147 feet; tallest tree, 164 feet; volume of timber, 14,300 cubic feet, equal to 168,000 feet, broad measure.

Thus, 160 years in Normandy have produced much taller trees, and nearly twice the volume of timber per acre, than 240 years in the Spessart. The explanation is that beech grows faster than oak, as previously explained, and that soil and climate are much more favourable. These are forests in Europe in about fifty degrees of north latitude. They are beaten out of sight by the exceedingly mild and moist climate on the western slope of the coast-range in California, at about thirty-eight degrees of north latitude. Here it is reported that some redwood-forests yield 250,000 or even 500,000 feet, broad measure, per acre, and this statement does not seem incredible, for in his book on the Forests of North America, Dr. Heinrich Mayr gives an account of a sample area examined by him, with fifty-six trees per acre, mean height 275 feet, containing 190,070 cubic feet or 2,240,840 feet, broad measure. However, the age of this wood was 700 years. It would be a delightful task to manage forests with such wonderful powers of timber production. One of the first points to make for would be to determine the earliest age at which the red-wood produces marketable timber of really good quality. But even if a rotation of, say 200 years, were found to be necessary, the rent per acre of such forests, managed on conservancy principles, would be very high.

The history of this fine and valuable German Forest may be understood if we examine the forest on the eastern slope of the Geierskopf near the top, which consists entirely of an open wood of old oak-trees, over 400 years of age, with a few beech. It is generally assumed, and this assumption is borne out by such old records as exist, that 400 to 500 years ago the higher portions of the Spessart were stocked with pure or nearly pure, oak-wood.

Now, it is one of the peculiar features of pure oak-woods, a peculiarity which that tree shares with the Scotch pine the larch and other trees, which, while young, demand much light and are impatient of shade ; that as the wood grows older it gradually gets thin and open, and the canopy of its foliage no longer completely shades the ground. An oak-wood raised by broadcast sowing or the result of self-sown seedlings will, at the age of twenty years, if fully stocked, have about 1,200 stems per acre ; when 100 years old, 250 to 300 only will be left, and of them at the age of 250 years seventy only will be left on the ground. The trees which disappear during the long life of the oak-wood are overtopped and gradually die out. In the higher portions of the Spessart it is probable that, besides the natural tendency of pure oak-woods to get thin and open when old, other factors were at work in the same direction. These woods were doubtless used in summer as the high level grazing grounds by the rich villages which studded the fertile open country. The grass under the partial shelter of scattered oak-trees is excellent, and the herdsmen doubtless meant, by fire or otherwise, to get rid of a portion of the trees. The result has been that these pasture-grounds on the higher ranges of the Spessart were like a gigantic park, studded with old oak-trees, forming open woods, the ground under the trees being clothed with a dense matting of grass. During the thirty years' war, however, these villages in the open country of Franconia were repeatedly devastated, and the cattle killed or driven away ; the young oak, therefore, which until then had been kept down by the cattle, took advantage of the opportunity, and on the occurrence of the first heavy oak-mast, dense thickets of oak sprang up and covered the ground. Oak-masts do not occur frequently in the Spessart. During the fifty years from 1820 to 1870 there have only been nine heavy seed years. In spring, when the tree is in blossom, night frosts frequently prevent the fertilization of the female flowers or kill the young fruit. Caterpillars, also, not rarely destroy both young leaves and flower-buds. A good oak-mast is naturally an event of the greatest importance in the Spessart and it generally occurs once in five or six years. The acorns, being heavy, do not fall far from the tree, but in a good seed year the ground near the mother trees is covered with acorns, and the nearly pure oak woods, 240 to 245 years old, most likely owe their origin to a heavy oak-mast which occurred soon after the close of the thirty year's war when there were no cattle left to eat and destroy the young seedlings.

In the forest-range of Rothenbuch which adjoins Rohrbrunn on the north, may be mentioned two smaller areas stocked with magnificent old woods of mixed oak and beech, one being the compartments Zuber and Denkstein, of 110 acres, where some 1,100 huge oaks, 375 years old are mixed with a large number of younger beeches 145 years old. The oaks are 115 feet high, with

tall, clean boles, the result of having grown up closely pressed by the beech. The stand on gentle slopes with southerly aspect on the north side of the Hofenlohr valley. Higher up on the same side of that valley is the famous wood known under the name of Metzgers Graben, about 250 acres, with seven oaks per acre, from 400 to 500 years old, magnificent trees 120 to 150 feet high, mixed with beech of all ages, giving the appearance of a virgin forest, in which all age-classes are represented.

FORMER TREATMENT OF THE FORESTS.

Smaller areas of similar character are numerous, but the largest proportion of old oak-trees are found scattered among the beech-forest at the rate of less than, say, two trees per acre, and in the woods, as a rule, the beech is younger than the oak. This remarkable fact, that old oak-trees are generally associated with beech of younger age, is mainly due to the circumstance that the oak has a longer life than the beech. Besides this, however, it must be remembered that formerly more beech was cut in certain portions of this forest than oak. In those days before the time of railways, when mineral coal had not yet been brought to every town and village, wood was the only fuel used, and on account of its great heating power the beech was preferred to all other kinds. In those days, roads did not exist in the Spessart and heavy oak-timber could only be brought away from the outskirts of the forest. In the higher and inner portions, the old oak-trees remained untouched, and their chief value was to shelter the summer grazing-grounds and to yield oak-mast for the numerous herds of swine that were driven into them from the rich valleys around. In those days, the Spessart was important, not merely on account of the oak it contained, but to a much greater extent supplying fuel in the shape of beech-wood. The treatment of these woods was by selection fellings, single trees being cut out here and there, as happened to be most convenient, without interrupting the canopy. Under such a system the beech will reproduce itself readily, for beech seedlings do not demand much light while young, but rather require shelter against sun and night frost. The oak, on the other hand, demands much light while young; the necessary result, therefore, has been extensive thickets of beech, without any young oak in them. The relation between oak and beech is not everywhere the same. In other parts of Germany, where soil and climate are particularly favourable for the growth of the oak, this tree holds its own in an even-aged mixture with the beech. In the Spessart, on the other hand, the oak is overtopped and finally killed by the beech wherever they grow together in thickets and have the same age.

At a later period, glass factories were established in many places in the Spessart, which consumed fuel on a very large scale. Their demands could not be satisfied under the old system of selection fellings; clear cuttings, therefore, became the rule. From the old records it appears that in 1729 orders were issued to the effect that in all clearances a certain proportion of shelter-trees should be left to shed seed and to insure the regeneration of the fruit by self-sown seed. This was the first step toward a regular system of natural regeneration under shelter woods, a method which at a later period, has given excellent results. In these early days, however, it is probable that the seed-trees left standing were mostly old spreading trees, under whose shade the Beech came up well, while the oak had no chance. As a matter of fact, there are hardly any oak-woods in the Spessart dating from the eighteenth century. There is almost a complete break between the woods on the north-west face of the Geiersberg with oaks dating from the middle of the seventeenth century and a considerable area of oak woods in different portions of the range, now 90 to 100 years old, which date from the end of the last and the commencement of the present century. Only very small plots are found here and there with oak-trees from 100 to 150 years old. Single oak-trees of that age and younger are scattered in beech-woods of the same age but, with very rare exceptions, they have been overtopped by the beech, the stems are lank and weak, the foliage is thin; in fact, they are living but lingering, and, in many instances, dying proofs that the oak has no chance against the beech, if growing in an even-aged wood, unless the beech in the vicinity of the oak is cut back or lopped from the commencement. Attempts have been made of late years, in some places, to save such oak-poles by girdling the beeches in the vicinity. Girdled beech-trees are weakened by the operation; their foliage gets thin and ultimately, in four or five years' time, they die. This operation, however, has been futile; the remedy has come too late, and of the numerous oak-poles and under-sized oak-trees which are scattered among even-aged beech woods, very few will attain a marketable size.

OAK-WOODS UNDERPLANTED WITH BEECH.

Of the younger oak-woods, those in the vicinity of the "Weissenstein," in the Rothenbuch range, may be noted. Here are 690 acres in one block, completely stocked with oak 50 to 100 years old, with a dense underwood of beech. At an elevation of 1,500 feet, a wood in which the oak in 1891 was ninety-eight years old, was found to contain 260 stems per acre, the mean height of wood being seventy-five feet; trunk diameters, breast high, eight to ten inches, and the beech underwood twelve to twenty feet high. In the Rhine valley at a

lower elevation (300 feet) and on richer soil, the oak shows a more rapid growth, attaining at that age ninety feet, with a diameter of twelve to fifteen inches. The underwood of beech in the woods last mentioned is not natural. Originally they were all nearly pure oak-woods. When forty to fifty years old, they were thinned heavily and underplanted with beech, and in places beech-nuts were sown to create an underwood of that tree. The object of this operation is to shelter the ground, and to promote the development of the oak. It has already been explained that thickets of pure oak are dense enough, but at a later stage, when the trees have attained the condition of poles, the wood becomes thin and the leaf-canopy is not sufficiently dense to shade the ground. The result is that the soil dries up and the stems become branched and irregular. The foliage of the oak, not being very dense, the leaf-fall does not enrich the soil in the same way as is the case in beech-forests. Hence the great advantage of an admixture of beech with oak. By far the most favourable condition of affairs is found where oak and beech grow up together from the commencement, provided the oak has a sufficient start so as not to be overtopped by the beech, or is protected against encroachment by lopping or cutting back the beech. When this is the case, the soil improves steadily, the oaks clear themselves at an early age of side-branches and form straight, tall, well-shaped stems. Where this has not been the case, in pure oak-woods, it is necessary at a later age to introduce the beech and to make heavy thinnings in order to enable it to grow.

SHADE-BEARING AND LIGHT-DEMANDING SPECIES.

Foresters make a distinction between trees which demand much light, such as the oak, the larch and the Scotch pine, and trees which endure much shade, such as the beech, the hornbeam, the silver fir, and, to a less extent, the spruce. The trees of the first-named class are called light-demanding; those of the second, shade-bearing. The difference between the two classes is very great and shows itself in a variety of ways. Light-demanding species are impatient of shelter while young, their foliage is light, and as explained before, woods consisting of them get thin and open when old.

On the other hand, shade-bearing trees, such as the beech and the silver fir, and to a less extent the spruce, are tender while young, being readily killed by sun and frost. These species, however, have the great advantage that they will spring up under shade, and although with an insufficient supply of light they will not make much progress; still, they will maintain themselves ready to shoot up whenever light overhead is given by the removal of shelter-trees. It follows that wood consisting of species which

stand much shade can be regenerated much more easily by self-sown seed than forests composed of oak, Scotch pine and other species which demand much light. Whether natural regeneration is attempted by the selection system, that is by taking out marketable trees here and there or by the group system, or by successive cuttings spread over considerable areas, compartments or sub-compartments, success is easy in the case of shade-bearing, because a slight cutting is sufficient to induce seedlings to come up; and secondly because the young growth will continue to live under a certain amount of shade, until subsequent cuttings give more light. Again, the foliage of shade-bearing trees is dense, improving the soil by an abundant leaf-fall. Forests consisting of these species always maintain a dense canopy of leaves.

On the other hand, trees which demand much light, such as the oak and Scotch pine, spring up and thrive without much shelter; their foliage is light, and pure woods of these species get thin with age, because the weaker trees do not get light enough, and perish. In such woods, the soil gets exposed to sun and wind, and deteriorates. Hence the finest oaks are found where they have grown up in company with the beech, or with the silver fir, as is the case in some instructive and valuable woods on the borders of the Black Forest, near Rastatt, Baden-Baden and Staufen. Hence the beech has justly been called the nurse of the oak, and the same may be said of the silver fir. In this respect the Scotch pine behaves like the oak. It nowhere attains such perfection as when it grows up in company with the beech, as we find it in the Steiger Wald of Bavaria, or when it is mixed with the spruce and silver fir, as we find it in the Black Forest.

In India the Teak is a tree which demands much light. This tree also thrives best, forming straight, clean, tall stems, when associated with shady kinds, such as the bamboo. And when the forests of North America come to be studied, from a forester's point of view, or rather, when they come to be managed in a regular and permanently profitable manner, the treatment of the different species will have to be guided by analogous considerations.

In endeavoring to set before American readers the management of the mixed oak and beech forests of the Spessart, we must be prepared for the objection, that these matters may be interesting from a scientific point of view, but that they cannot possibly be of any practical utility in managing North American forests. The trees are different, the climate is different. The American forester is skilful; he is full of resource, bold and energetic. He cannot possibly be expected to have the patience to find out whether the trees of his forest are light-demanding or shade-bearing. This would take much too long, and would interfere with business. However, it may not be out of place to state here that when the writer of these lines, in 1850, discovered

that teak was a light-demanding tree, he laid the foundation for the systematic management of the teak forests in Burma, which has proved successful on a large scale, and will be lasting. There is no help for it; if forest proprietors in the United States wish to leave to their children forest estates, the value of which will grow steadily, or if foresters, with a still higher aim, desire to confer lasting benefits upon their country by inaugurating a good system of forest-management, they must follow the example of foresters of Germany and other countries of Europe, and study the requirements of American forest-trees in the matter of light and shade. This is at the root of good forest-management in all countries. *D. Brandis in 'Garden and Forest.'*

Mr. Cotes' Zoology Manual.

The encouragement given to scientific instruction and research by the Indian Government is known to all who see the many interesting and important publications which issue from the different departments. Most branches of natural knowledge are fostered in India with a care which could be followed with advantage in the British Isles. The work before us is not a voluminous report, nor is it a richly illustrated monograph of the kind that often emanates from the various departments of the Government. In its way, however, it will do excellent service by providing a course of zoology suitable for the use of students at the Imperial Forest School, Dehra Dun. The author, who is lecturer on Zoology in that School and Deputy Superintendent of the Indian Museum, points out that the particular animals with which the Indian Forest Officer is concerned are not treated in sufficient detail in the general text-books. His manual admirably supplies the requisite information and furnishes a sound elementary course on the classification and habits of the commoner Indian animals. The work is divided into two parts, the first of which is a systematic course, while the second consists of directions for the dissection and examination of specimens. Theory and practice are thus each given a proper share of consideration. The book is a practical one, and the theoretical matter included in it is only such as is likely to be of use to the students for whom it has been designed. Little reference is therefore made to the fundamental theories of modern biology.—*Nature*.